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FORSTER'S Arithmetick.

EXPLAINING

The Grounds and Principles of that Art, both in whole Numbers and Fractions.

By ſuch Plain, Eaſie and Familiar Rules and Precepts, that any Perſon, of a reaſonable Capacity, may (in a ſhort time) attain to a competent Proficiency therein, without the help of any Tutor.

By *WILLIAM FORSTER.*

LONDON,

Printed by *John Streater*, and are to be ſold by *George Sawbridge*, at the Bible on *Ludgate-Hill*, 1673.

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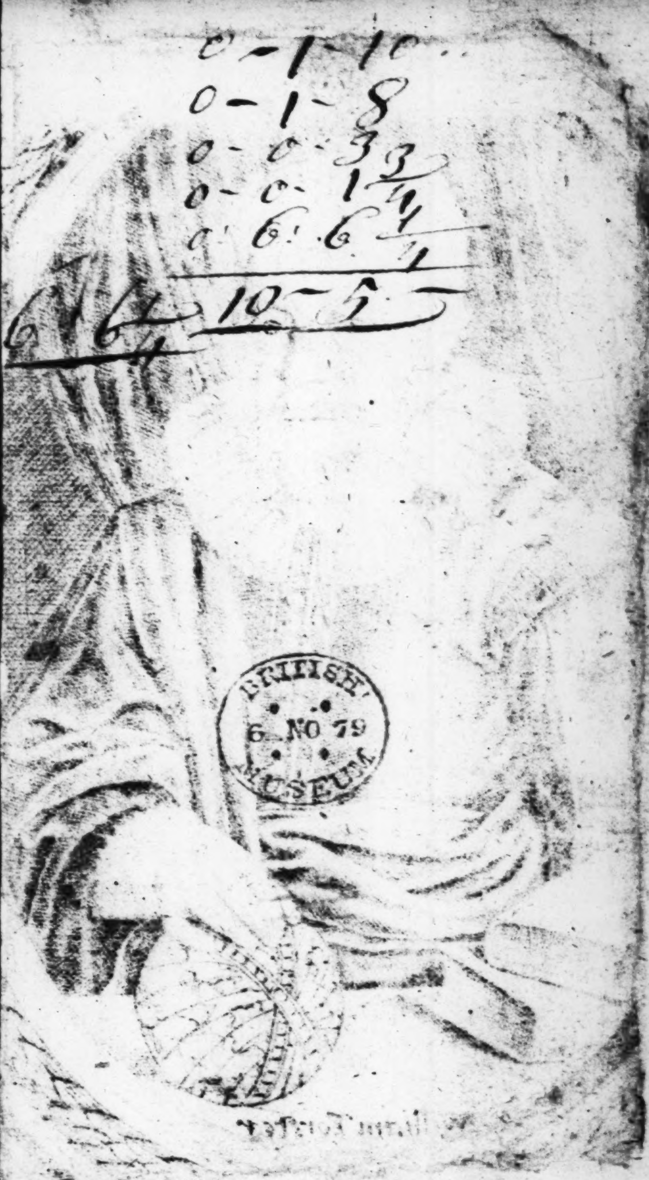


William Forster

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TO ALL

Merchants, Factors,

Accomptants and others, desirous of Knowledge in the Useful ART of ARITHMETICK.

THis Treatise *I here present to your View, is Principall intended for the Instruction of such as are desirous to attain to a Perfection of Knowledge in the Art of* Arithmetick: *The chief Scope and design hereof being to lay down the whole Rules of the said Art, in so plain and easie a Method, that any one of a reasonable Capacity may soon comprehend them: And all who have not the convenience of a Master or Tutor, may hereby alone attain a competent perfection therein, without the Aid or Assistance of any to instruct them. The Method observed in the Composure is a gradual proceeding Step by Step, and from Rule to Rule, as they ought to be read and practised beginning with* Numeration, *in which there*

are more than ordinary Tables fitted for the true and easie numbering of many Figures together——Addition, *and that is furnished with Examples both of* Coyn, Weights, Measures, Time, *&c. and so is* Substraction *also*—Multiplication *is as in others, onely here and there are necessary* Compendiums *added*——*And in* Division, (*which is the most difficult of all the Species*) *there are different wayes of working that* Rule, *so that any person may use that which he best apprehendeth or liketh.*

Having finished these four Primary, or (indeed) fundamental parts of Arithmetick, *I proceed next to* Reduction, *where (as in* Addition) *there are Examples also of* Money, Weights, Measures, *and* Time, *and from thence to the* Golden-Rule of Three Numbers, *both* Direct *and* Retrograde; *all hitherto being performed in* Whole Numbers *only.*

After this, I proceed to Fractions, *beginning with* Numeration, Multiplication, Division, Reduction, Addition, *and* Substraction. *The reason of which Method is, because* Fractions *may be* Multiplied *and* Divided *without* Reducing, *but they cannot be* Added *or* Substracted, *but they must first be* Reduced.

The Ordinary, general, and most useful Rules,

Rules, *being hitherto explained, both in* Whole Numbers *and* Fractions, *I proceed to those of more particular concern to* Merchants, Factors, Tradesmen, *and the like; and such are* Rules of Practice, The Double Rule of Three, Company *or* Fellowship, *with, or without,* Time, Exchange, Barter, Alligation, *and the like. All which, every Rule in the directions thereunto belonging do sufficiently explain and demonstrate.*

Lastly, The Course and Method being observed, the young Practitioner may in a short time attain to such a competent proficiency in this Art of Vulgar Arithmetick, *so far forth as to make him capable of any employment in way of Trade, or Merchandise; for such I write it, and to such I recommend it, wishing them good success in all their honest* Endeavours *and Practices, and so I bid them*

Farewell.

To the Reader.

[illegible]

OF ARITHMETICK.

ARITHMETICK is the Art of Numbring well, to the attaining whereof belongeth the knowledge of *Figures*, which are in number *Nine*, to which is added an [o] which makes *Ten*. Of which nine Figures, and the [o] (called a Cypher,) all other Numbers, how great foever, are compounded.

Of *Numbers* there are three forts.

1. *Digit Numbers*, which are all Numbers under *Ten*.

2. *Article Numbers*, which are all Numbers that confift of any one *digit number* and a *Cypher*, as *Ten*, *Twenty*, *Thirty*, &c.

3. *Compound Numbers*, which are any number of Figures alone, or with Cyphers and Figures mixed together, as *Seven hundred eighty four*, which confifts of three Digit Numbers put together, or *Three hundred and feven*, which confifts of two Digits and a Cypher intermixed.

Having declared unto you what Number

is, I will now shew you the Characters and places of the Nine Figures and the Cypher before mentioned, which is the Office of *Numeration*, which is the first part, or rather, the first step to *Arithmetick*.

CHAP. I.

Of NUMERATION.

NUMERATION is that part of Arithmetick which teacheth how to read any summe of Figures that is written down, or to write down any summe that shall be desired: to the attaining whereof, it is necessary first to know the Names and Characters of the Figures, which are as followeth,

One	Two	Three	Four	Five	Six	Seven
1	2	3	4	5	6	7

Eight	Nine	Cypher.
8	9	0

And here note, That the Cypher it self signifieth nothing, but being adjoyned with any other Figure or Figures, it augmenteth or maketh up the place of that Figure or Figures ten times; or if there be added two

Cyphers,

Cyphers, it augmenteth the Figure or Figures an hundred times, as the Figure 2 standing alone, signifieth only *two*, and is so called; but if to it you adjoyn a Cypher thus, 20, it maketh the *two* ten times two, that is, *twenty*, and must be so called. But again, if to the forementioned *two*, you adjoyn two Cyphers thus, 200, it augmenteth the *two* an hundred times, that is, it maketh it *two hundred*, and must be so called.

Note, That what is here said of the Figure *two*, is to be understood of any other figure, as the following Table plainly expresseth.

First place, or place of unites.		Second place, or place of tens.		Third place, or place of hundreds.	
1	one	10	ten	100	one hundred
2	two	20	twenty	200	two hundred
3	three	30	thirty	300	three hundred
4	four	40	forty	400	four hundred
5	five	50	fifty	500	five hundred
6	six	60	sixty	600	six hundred
7	seven	70	seventy	700	seven hundred
8	eight	80	eighty	800	eight hundred
9	nine	90	ninety	900	nine hundred

By this Table you may plainly see, that the Figure of 1, standing alone in the first place, or place of unites, signifieth barely One, and 2 Two, and 3 Three. But 1 standing in the

ſecond place, or place of Tens, ſignifieth Ten, and 2 Twenty, and 3 Thirty. And *one, two,* or *three* ſtanding in the third place, or place of Hundreds, ſignifieth 100 one Hundred, 200 two Hundred, 300 three Hundred, *&c.*

Again, if to *one, two,* or *three,* you adde three Cyphers, we call that the fourth place, or place of thouſands, and we in that place call one, two, or three [1000] one thouſand, [2000] two thouſand, [3000] three thouſand, & ſo on to what number of places you pleaſe.

So, the fifth place is the place of ten thouſands. The ſixth place is the place of hundred thouſands. The ſeventh place is the place of millions. The eighth place is the place of ten millions. And the 9th place, is the place of an hundred millions, as in the following Table.

Numbers.	Places.
1 one	1
10 ten	2
100 an hundred	3
1000 a thouſand	4
10000 ten thouſand	5
100000 an hundred thouſand	6
1000000 a million	7
10000000 ten millions	8
100000000 an hundred millions	9

Having

Having given you the names and places of the nine Figures, and how they are augmented by the continual adding of Cyphers, I will now shew you how to read any great summe that shall be written down.

Let it be required to read this number of Figures, 763587254. for the ready doing whereof, make a prick with your pen between every third figure, beginning at the right hand, as is here done, 763. 587. 254. these pricks divide the great number into smaller numbers, namely into 763. 587. and 254.

Now the first three Figures towards the left hand, namely, 763, stand in the place of Millions and must be called 763 millions.

The second three Figures, namely, 587, stand in the place of thousands, and must be called 587 thousand.

The three Figures which stand next the right hand, stand in the place of Hundreds, and must be called 254, two hundred fifty four.

And the whole number together is thus to be read, Seven hundred sixty three millions, five hundred eighty seven thousand, two hundred fifty four.

And

And by this diſtinction may any great ſum be eaſily read, an example whereof you have in this following Table.

3	Three
27	Twenty ſeven
304	Three hundred and four
3.461	Three thouſand, four hundred ſixty one
40.572	Forty thouſand, five hundred ſeventy two
358.206	Three hundred fifty eight thouſand, two hundred and ſix
6.982.471	6 millions, 982 thouſand, four hundred ſeventy one
98.423.175	98 millions, 423 thouſand, one hundred ſeventy five
736. 528. 379 (place of millions; place of thouſands; place of hundreds)	Seven hundred thirty ſix millions, five hundred twenty eight thouſand, three hundred ſeventy nine.

CHAP.

CHAP. II.

Of ADDITION.

ADDITION is the collecting or gathering together of divers smaller summes into one entire or gross summe.

For the performance whereof, this is *The RULE, Let the several smaller summes be set in order one under another, as Unites under Unites, &c. and underneath them draw a line, then beginning with the lowermost figure of the last rank (which is that next your right hand) adde all the figures in that rank together, then consider how many Tens the addition of that rank contains, and for every Ten keep one Unite in mind to be carried to the next rank of Figures, and what odd Digits there are, above the Tens, set down under that rank beneath the line. Having finished one rank of numbers, proceed to the second, and from that to the third, &c.*

EXAMPLE.

Paid at several times to several persons, these summes following.

	lib.	
To Mr. *Green*	937	*Apr.* 7. 1654.
To Mr. *Ward*	772	*Apr.* 16.
To Mr. *Smith*	53	*May* 4.

Sett

Set the ſeveral ſums in order as you ſee in the Example, and draw a line under them, then beginning with the laſt rank of Figures, which is that towards the right hand, begin with the lowermoſt Figure thereof, which is 3, ſaying, 3 and 2 is 5, and 7 is 12, ſet 2 under the line, and carry one Unite to the next rank of Figures (becauſe there was one Ten in the addition of that rank) ſaying, One as I carried and 5 is 6, and 7 is 13, and 3 is 16, ſet 6 under the line, and carry one Unite to the next rank, ſaying in your mind, One which I carried and 7 is 8, and 9 is 17, ſet 7 under the line, and carry one to the next rank; but ſeeing there are no more ranks to carry your Unite to, therefore you muſt ſet it down, and your ſumme will ſtand as here you ſee, The total or groſs ſumme whereof being 1762 *l.* And in this manner may you adde as many or as few ſums together as ſhall be required, as by the Examples following may appear, which I have onely ſet down for young beginners to practice by.

lib.
937
772
53
1762

Crowns

Crowns	Yards of Cloth.	Barrels of Sope.	Tuns of Wine.
6250	579	5002	57
4621	364	460	84
872	851	200	36
60	963	69	23
——	26	83	
In all 11803	14	——	200
Crowns.	8	5814	Tuns.
	—	Barrels.	

In all 2805 Yards of Cloth.

Addition *of Numbers of divers denominations.*

By numbers of divers denominations, is meant ſuch numbers as conſiſt of themſelves and their parts, as if the ſummes be of money, then the greateſt denomination is of Pounds, and the parts of a Pound are Shillings, and the parts of a Shilling are Pence, and the parts of a Penny are Farthings, which is the ſmalleſt of Engliſh money.

Now to perform the work of Addition of Numbers of divers denominations, this order is to be obſerved.

The RULE.

Place all Numbers of the ſame denomina-

tion

tion, one directly under another, as pounds *under* pounds; shillings *under* shillings; pence *under* pence; *and* farthings *under* farthings. *Then draw a line under them, and begin your Addition with the least denomination first; observing, how many times the next greater denomination, is contained in the next lesser; and for every time carry one unite to the next denomination (as before you did the tens) setting down the remainder, if any be, then adding the next denomination together, take notice how many times the next greater denomination is contained in that lesser, carrying for every time one to the next denomination greater; thus proceeding till you have gone over all the denominations, be they never so many.*

Example 1. Let the numbers to be added be 29 li. 16 s. 8 d.
32 li. 17 s. 9 d.
81 li. 13 s. 11 d.
and let it be required to find the total or gross summe.

li.	*s.*	*d.*
29	16.	8.
32	17.	9.
81	13	11
144	08	4

Here in this Example the least denomination is pence, therefore I begin with them, and say, 11 *d.* and 9 *d.* is 20 *d.* which is 1 *s.* and 8 *d.* make a prick against the 9, and say, 8 *d.* and 8 *d.* is 16 *d.* that is 1 *s.* 4 *d.*

make

make a prick againſt the 8. and ſet down the odd 4 *d.* then (becauſe there are two pricks in the line of pence) you muſt carry 2 s. to the place of ſhillings; ſaying, 2 s. which I carry and 13 s. is 15 s. and 17 s. is 32 s. which is 1 l. 12 s. make a prick againſt 17. and ſay 12 s. and 16 s. is 28 s. make a prick againſt the 16. and (becauſe there is no more numbers to be added) ſet down the odd 8 s. under ſhillings, and (being there is two pricks in the line of ſhillings) carry 2 to the place of pounds, ſaying 2 and 1 is 3, and 2 is 5, and 9 is 14, ſet down 4, and carry 1 to the next line, and ſay 1 and 8 is 9, and 3 is 12, and 2 is 14, which (becauſe it is the laſt) you muſt ſet down, ſo is the total or groſs ſumme 144 l. 8 s. 4 d.

Example 2. Let the numbers to be added together be 37 *li.* 16 *s.* 9 *d.* 3 *q.* 21 *l.* 9 *s.* 8 *d.* 1 *q.* 13 *li.* 2 *s.* 9 *d.* 2 *q.* Place the numbers as in the margine, draw a line under them, and begin with the leaſt denomination (which in this Example is farthings) firſt, ſaying, 2 *q.* and 1 *q.* is 3 *q.* and 3 *q.* is 6 *q.* which is one penny, and

li.	*s.*	*d.*	*q.*
37	16	9.	3.
21	09.	8.	1.
13	12	9	2
72	19	3	2

2 *q.*

2 *q.* remaining, which 2 *q.* I place under the line, and carry the one penny to the next row which is the place of pence, ſaying, one peny and 9 *d.* is 10 *d.* and 8 *d.* is 18 *d.* which is 1 *s.* and 6 *d.* [*Now againſt the* 8. *I make a prick with my Pen for my better remembrance, to ſignifie that there is one ſhilling to be carried to the place of ſhillings,*] then go on and ſay 6 *d.* and 9 *d.* is 15 *d.* which is 1 s. 3. d. therefore againſt 9. I make a prick with my pen, and (becauſe that is the laſt number) I ſet down the odde 3 d. under the place of pence, and (becauſe I find two pricks in the line of pence, therefore) I carry 2 s. to the place of ſhillings, ſaying, 2 s. which I carried, and 12 s. is 14 s. and 9 s. is 23 s. which is one pound and 3 s. remaining, I make a prick againſt 9. and going on, ſay 3 s. and 16 s. is 19 s. which (being there is no more numbers to be added, and being alſo leſs then 20 s.) I ſet under the line, and finding one prick in the line of ſhillings, I therefore carry one to the place of pounds, ſaying, one which I carried and 3 is 4, and 1 is 5, and 7 is 12, ſet down the 2 under the line (as in addition of numbers of one denomination) and carry 1 to the next row, ſaying, one that I carried and 1 is 2, and 2 is 4, and 3 is 7, which being the laſt I ſet down, and ſo the total or groſs ſum is 72 *li.* 19 *s.* 3 *d.* 2 *q.*

Some

Some other Examples ready wrought, for Learners to practice by.

l.	s.	d.
365	13	9.
721	06.	3
200	00	0
69	13	4
1356	13	4

l.	s.	d.	q.
63	13.	4.	1
52	13.	9	3.
61	5	2.	2.
9	11	9	3
187	04	2	1

Thus much for *Addition of Engliſh Money*, which order is alſo to be obſerved in the addition of the Moneys of other Countreys, ſo that there is no difference, if you do but know how many of the ſmaller denominations make one of the next greater. And what hath been here ſaid of *Money*, is likewiſe to be underſtood of *Weights*, *Meaſures*, *Time*, &c. Examples of all which here follow. And firſt of

Addition of Troy Weight.

The moſt uſual Commodities weighed by this kind of weight, are *Gold*, *Silver*, *Pearl*, *and Bread*: and the ſeveral denominations of this weight are *Pounds*, *Ounces*, *Penny-weights*.

weights and *Grains*, whereof a *Grain* is the least; of which,

24 Grains make one Penny-weight.
20 Penny-weights make one Ounce, and
12 Ounces make one Pound.

Now in the addition of this kind of weight, you must at every 24 grains make a prick, and for every prick carry so many penny-weights to the place of penny-weights, [because 24 grains make one penny-weight.] Again, at every 20 penny-weight make a prick, and for every prick carry so many ounces to the place of ounces, [because 20 penny-weights make one ounce.] Lastly, at every 12 ounces make a prick, and for every prick carry so many pounds to the place of pounds, [because 12 ounces make 1 pound] as by examples following will appear.

Example. Let the Numbers to be added together be 7 *li.* 11 *ou.* 13 *pw.* 19 *gr.* 6 *li.* 7 *ou.* 16 *pw.* 19 *gr.* 3 *li.* 7 *ou.* 9 *pw.* 6 *gr.* Place your numbers as in addition of money, each under other according to their respective denominations as in the margine, then

li.	*ou.*	*pw.*	*gr.*
7	11.	13	19
6	07.	16.	19.
3	07	09	06
18	02	19	20

draw-

draw a line under them, and begin your addition with the least denomination first, *viz.* Grains; Saying, 6 *gr.* and 19 *gr.* is 25 *gr.* which is one penny-weight and one grain, make a prick against 19. and carry the odde grain to the number above, saying, 1 *gr.* and 19 *gr.* is 20 *gr.* which (because it is less then one penny-weight) I set under the line, then finding one prick in the line of grains, I (therefore) carry one to the place of penny-weights, saying, 1 and 9 is 10, and 16 is 26, which is one ounce, and 6 penny-weight, make a prick against 16. and say 6 and 13 is 19, which (being less than an ounce) set under the line; then for the one prick, carry 1 to the place of ounces, saying, 1 and 7 is 8, and 7 is 15, which is one pound and 3 ounces, make a prick at 7. and say, 3 and 11 is 14, which is one pound and 2 ounces, set down the 2 ounces, and for the two pricks carry 2 pounds to the place of pounds, saying, 2 and 3 is 5, and 6 is 11, and 7 is 18, which set under the place of pounds, so is your addition ended, and the summe is 18 *li.* 2 *on.* 19 *pw.* 20 *gr.*

Other

Other Examples for Practice.

li.	*ou.*	*pw.*	*gr.*	*li.*	*ou.*	*pw.*	*gr.*
32	9.	12	16	0	10	17.	11
17	11.	6	9.	0	6.	0	5
34	8.	15.	10	0	0	16	8.
8	10	4	7	0	5	2	19
94	3	18	18	1	10	16	19

Addition of Avoirdupois little weight.

The Commodities weighed by this kind of weight are such as are garbleable, as *Ginger*, *Cloves*, *Mace*, *Pepper*, *Cinnamon*, &c. and the several denominations of this weight are *Pounds*, *Ounces*, and *Drachms*, of which

16 Drachms make one Ounce, and
16 Ounces make one Pound,

therefore prick at every 16 drachms, and for every prick carry so many ounces to the place of ounces. Again, prick at every 16 ounces, and for every prick carry so many pounds to the place of pounds, as by the Examples following appeareth.

Examples

Examples of Addition of Averdupois little weight.

li.	*on.*	*dr.*	*li.*	*on.*	*dr.*
12	11.	09	06	93.	07.
76	05	12.	05	09.	12
32	10.	00	06	03	09.
91	07.	13.	10	00	00
32	13	07	05	07	09
246	00	09	34	02	05

Addition of Avoirdupois great weight.

By this weight are weighed all commodities that are sold by the Hundred (the Hundred weight containing 112 pound) as *Butter, Cheese, Wooll, Flax, Corans*, &c. and the several denominations of this weight are Hundreds, Quarters, Pounds and Ounces, of which

16 ounces make one pound.
28 pound makes a quarter of an hundred.
4 quarters makes an hundred weight, *viz.* 112 pound.

wherefore, for every 16 ounces carry one pound, for every 28 pounds carry one quarter, and for every 4 quarters carry an hundred

hundred weight, as in the Examples following.

C.	q.	l.	ou.	C.	q.	l.	ou.
632	3.	16.	12.	35	1	09	11.
761	2	07	03	21	3.	02.	00
499	3.	12	09	16	2	14	12
1894	1	08	08	73	3.	10	07

Addition of Cloth measure.

By this measure is commonly measured *Linnen* and *Woollen Cloth*, and all kind of *Stuffs*, *Silks*, *Sattins*, *Velvets*, &c. and the several denominations of this measure are *Ells*, *Yards*, *Quarters*, and *Nails*, of which

4 Nails make one quarter of a yard.
4 quarters make one yard, and
5 quarters of a yard make an ell.

Therefore, for every 4 nails carry one quarter, and for every 4 quarters carry one yard.

But for Ells, for every 5 nails carry one quarter, and for every 4 quarters carry one ell, as in these Examples.

Yards

Yards	*qu.*	*nails*	*Ells*	*qu.*	*nail*
325	2	3.	631	3	3.
65	1	2.	25	1.	2
31	3.	1	16	3	4.
65	3.	2	31	2.	3
488	3	0	705	3	2

Addition of Dry measure.

By this measure is measured *Salt*, *Coals*, and *Corn*, &c. and the common denominations are *Bushels*, *Pecks*, and *Pints*, of which.

16 Pints make one Peck, and
4 Pecks one Bushel.

Wherefore, for every 16 pints carry one peck, and for every 4 pecks carry one bushel, as in the Examples following.

Bush.	*Peck.*	*Pin.*	*Bush.*	*Peck.*	*Pin.*
276	3	9	161	3	13
162	0	4	91	2	12
630	3	12	64	3.	11
1069	3	09	318	2	04

Addition of Wine measure.

The denominations of Wine measure are *Tuns*, *Hogsheads*, *Gallons*, *Pottles*, *Quarts*, *Pints*, of which.

2 Pints make one quart.
2 Quarts one pottle.
2 Pottles one gallon.
63 Gallons one hogshead.
4 Hogsheads one Tun.

Therefore for every 2 pints carry one quart.
For every 2 quarts one pottle.
For every 2 pottles one gallon.
For every 63 gallons, one Hogshead, and
For every 4 Hogsheads, one Tun.
as in the Example.

Tun	*hogsh.*	*gal.*	*pottle*	*quart*	*pint.*
632	3	60.	1	0	1.
269	2.	40	0	1.	0
672	1	16	1.	0	1
1574	3	54	1	0	0

Addition

Addition of Long measure.

By which is measured any *Distance*, as from one place to another, or the *height* of any Building, or the *length* of any Gallery, or of any piece of *Timber*, or Masts of Ships, *&c.* The usual denominations whereof are *Yards*, *Feet* and *Inches*, of which

12 Inches make one foot, and
3 Foot one yard.

Therefore, for every 12 Inches carry one foot; and for every 3 foot carry one yard, as in these Examples:

Yards	*feet*	*inches.*	*Yards*	*feet*	*inches.*
3261	2.	9.	325	1	11.
376	1	0	96	2.	3.
127	2.	10	64	0	10
3766	0	07	486	2	00

Addition of Time.

Time is measured by *Years*, *Dayes*, *Hours*, and *Minutes*, of which

60 Minutes make one hour.
24 Hours one day natural, omitting the odde hours, which in 4. years makes one day, and is added in *February*

every Leap-Year; And
365 dayes one year.

Wherefore, for every 60 minutes carry one hour, for every 24 hours carry one day, and for every 365 dayes carry one year, as in the Examples following.

years	*dayes*	*hours*	*minutes.*
5670	208	16.	30
654	345.	20.	45.
276	16	11	24
69	54	23.	52
6670	258	00	31

Let this suffice for the practice of Addition; next for the proof thereof,

The Proof of Addition.

Having placed your numbers in order, and added them together, and set the Total under the line, *Cut off the upper number by drawing a line with your Pen betwixt that and the others, then add all the numbers together except the uppermost, and set the Total of them under the Total before found, then add this last Total, and the first number which you cut off with your pen together, and if the sum of those two numbers be equal with your total sum*

first

first found, then is your work right; otherwise not.

Example. In the first example of whole numbers, the sums to be added were 937, 772, and 53, these numbers placed in due order and added together, the total or gross summe of them was 1762; now to prove whether this Total be true or not, I cut off the uppermost number (to wit 937) with a dash of the pen, and I adde the other two numbers together, namely, 772, and 53, and the total of them is 825, which number being added to 937, (the number cut off) the sum of them is 1762, exactly agreeing with the Total first found, and proves the addition was truly performed; But if they had disagreed, then the work had been erroneous. The like course must be taken for the proof of those summes which have different denominations; as in Money and Weight, as by the Examples following will appear.

Another Example.

	7822
	———
	5609
	376
	8547
	———
first Total	22354
	———
last Total	14532
	———
Proof	22354

Other Examples proved.

1 *Exam. of Money.*

	li.	s.	d.	q.
	37	16	9	3
	21	9	8.	1
	13	12	9	2
1 Total	72	19	3	2
2 Total	35	2	5	3
Proof	72	19	3	2

2 *Exa. of Troy weight.*

li.	ou.	pw.	gr.
32	9	12	16
17	11	6	9
34	8	15	10
8	10	4	7
94	3	18	18
61	6	6	2
94	3	18	18

CHAP. III.

Of SUBSTRACTION.

As by Addition was taught, that by the adding of two or more numbers together, there was produced another number which was equal to all the other numbers, and was called the Sum or Total of them. So Substraction teacheth the contrary, namely, by having one or mo. e small sums to be taken

out

out of one greater sum, it sheweth what part of the greater sum is left behind when such substraction is made, which part so left behind is called the *Remainder*, or *Residue*.

And as in *Addition* the sums to be added may be either of the same denomination, or of different, so also may they be in *Substraction*, and the manner of placing them is the same, that is, *Unites* under *Unites*; *Tens* under *Tens*, &c. placing alwayes the greater number uppermost, as by examples following will appear.

1. Substraction *of numbers of one denomination.*

Example 1. Let it be required to substract 2976 out of 96527, *The RULE. Place the numbers one under another as in Addition, and draw a line under them, and beginning with the first figure towards your left hand, say* 6 *out of* 7, & there remains 1, place 1 under the line, & proceed to the next figure, saying 7 out of 2 I cannot (*wherefore you must alwaies add* 10 *to the number above, which in this example is* 2, *and it makes* 12,) therefore take 7 out of 12, and there remains 5, place 5 under the line, and (*because you added* 10 *to the* 2 *to make it* 12, *you must*)

96527
2976
93551

carry a unite to the next figure, saying, one which I carried and 9 is 10, take 10 out of 5, which I cannot, therefore I must adde 10 to 5, and it makes 15, and say 10 out of 15, and there remains 5, place 5 under the line, and (*because you added* 10 *to* 5 *to make it* 15, *you must therefore*) carry a unite to the next figure, saying, one which I carried and 2 is 3, take 3 out of 6 and there remains 3, place 3 under the *line*, and because there is no more figures to be substracted from the number above, you must say, nothing from 9 and there remains 9, set the 9 under the line, and your substraction is ended.

Other Example.

Out of	9635	quarters of Wheat
Take	964	quarters
Remains	8671	quarters.

Bought	2106	hogsheads of Wine
Sold at seve-ral times	120 235 94	hogsheads
Sold in all	449	hogsheads
Remains	1657	hogsheads unsold.

Substra-

Substraction of Numbers of divers denominations.

The RULE.

In substraction of Numbers of divers denominations, you must observe the same order as in Addition, namely, to place every number in due order, with respect to its denomination, as pounds under pounds, shillings under shillings, &c. the greater number alwayes uppermost, and drawing a line under them, begin with the least denomination first, substracting it from the line above, and setting the remainder under the line as in whole numbers; but if the pence or shillings in the upper row be smaller then those in the neather row, you must add 12 d. or 20 s. to the smaller number, that so substraction may be made, as by examples following will appear.

Example. Let it be required to substract 2628 li. 16 s. 10 d. out of 9320 li. 10 s. 7 d. place the numbers in order, and beginning with the pence, say 10 d. out of 7 I cannot, therefore I must add 12 d. (which is one shilling) to 7 d. and it makes 19 d. but 10 d. out of

	li.	s.	d.
Lent	9320	10.	07
Paid	2628	16	10
Rests	6691	13	9

19 d. and there remains 9 d. set the 9 d. under the line; and (because I added 12 d. to 7 d.) I must therefore carry one to the place of shillings, saying, 1 s. which I carried, and 16 s. is 17 s. then 17 s. from 10 s. I cannot take wherefore I must adde 20 s. (which is one pound) to 10 s. it makes 30 s. and 17 s. out of 30 s. and there remains 13. set 13 under the line, and carry one to the place of pounds, saying, one which I carried and 8 is 9, take 9 out of 0 I cannot, but 9 out of 10 and there remains one, set 1 under the line, and carry a unite to the next place, saying, one which I carried and 2 is 3, take 3 out of 2 I cannot, but 3 out of 12, and there remains 9, place 9 under the line, and carry one to the next place, saying 1 which I carried and 6 is 7, take 7 out of 3 I cannot, but 7 out of 13, and there remains 6, place 6 under the line, and carry one to the next row saying 1 and 2 is 3, take 3 from 9 and there remains 6, place 6 under the line, so is your Substraction ended, and the remainder is 6691 li. 13 s. 9 d.

Example. 3. Suppose a man had lent to another man 1000 pound, and that the borrower had paid thereof at one time 127 li. at another time 430 li. 10 s. and at a third payment 50 li. and the creditor would know

how

how much he hath received, and how much is owing of his debtor.

	li.	s.	d.
Money lent	1000	00	00
	127	00	00
Paid at seve-	430	10	00
ral times	50	00	00
Paid in all	607	10	00
Rests to pay	392	10	00

Place the numbers as here you see, first the sum of money lent, and draw a line under it, then set the sums paid at several times one under another, and draw a line under them: Then add all the sums which have been paid at several times together, which make 607 li. 10 s. which is the sum which the debtor hath paid in all, then substract this 607 li. 10 s. from 1000 li. and there will remain 392 li. 10 s. and so much is still owing to the Creditor.

Another Example.

	li.	s.	d.	q.
Money in Cash	3962	9	3	2
Goods bought at Money	1276	8	9	1
Paid for Custome	176	11	2	0
Disburst	1452	19	11	1
Rests in Cash	2509	9	4	1

Example.

Example in Troy-weight.

	Oun.	*pw.*	*gr.*	
Received	635	16	12	of Plate.
Returned	467	13	7	of Plate.
Remains	178	03	05	

Example in Avoirdupois great weight.

	C.	*qr.*	*li.*	*ou.*	
Bought	621	3	20	10	of Cheeſe.
	12	0	6	4	
ſold at	9	3	12	1	
ſeveral	16	2	9	7	
times	32	3	11	12	
ſold in all	71	1	11	8	
unſold	590	2	9	2	

The Proof of Subſtraction.

The Proof of Subſtraction is performed by Addition, for adding the number to be ſubſtracted, to the remainder, the ſum of them muſt be equal to the number given, if you have

have truly wrought. As in the example of numbers of one denomination,

the number given is	96527
the number to be substracted is	2976
the remainder is	93551
Proof	96527

CHAP. IV.

Of MULTIPLICATION.

MULTIPLICATION is no other then a Compendium of Addition, neither doth it perform any thing that may not be done thereby, only Multiplication performeth that at one working, which to perform by Addition would require many, as if you would know how much 26 times 8 is, it would be tedious to set down 26 eight times, and then to adde them together, which when you had done, you should find the sum to be 208, this I say to perform by Addition would be tedious, but by Multiplication very expeditious and easie, as will appear.

Before you enter upon the practice of *Multiplication*, it is necessary to have in remembrance perfectly the product produced by

by the Multiplication of any one of the nine Digits, by any other of the same, as readily to know, that 4 times 5 is 20, 6 times 7 is 42, 2 times 9 is 18. 7 times 9 is 63, 8 times 9 is 72. &c. Which this Table following will plainly declare, and must be perfectly learned by heart before you attempt to multiply great numbers.

The Table of Multiplication.

1	2	3	4	5	6	7	8	9
2	4	6	8	10	12	14	16	18
3	6	9	12	15	18	21	24	27
4	8	12	16	20	24	28	32	36
5	10	15	20	25	30	35	40	45
6	12	18	24	30	36	42	48	54
7	14	21	28	35	42	49	56	63
8	16	24	32	40	48	56	64	72
9	18	27	36	45	54	63	72	81

The use of the Table of Multiplication, and the manner how to read it:

The use of this Table is to find the sum or product of any digit multiplied by it self,

or of any two digits multiplied one by the other, as if you would multiply 8 by 8, look in the square of the Table where the two lines from 8 in the side of the Table, and 8 in the top of the Table do meet, and in that square you shall find 64, and so much is the sum or product of 8 multiplyed by 8.

Again, if you would multiply 6 by 8, look in the side of the Table for 6, and in the top of the Table for 8, and in that square where 6 in the side and 8 in the top do meet, you shall find 48, and so much is the sum or product of 6 multiplied by 8, or of 8 multiplied by 6, which is all one, for 6 times 8, and 8 times 6 is one and the same.

So in the Table, if you find 8 in the side of the Table and 6 in the top, in that square where those two lines meet, you shall also find 48, as before.

And so for any other two digits, as 7 times 8 is 56, 4 times 9 is 36, 8 times 5 is 40, and so of any other two digits.

In *Multiplication* three things or terms are to be considered, namely;

The *Multiplicand*,
The *Multiplier*, and
The *Product*.

The *Multiplicand* is the number to be multiplied.

The

The *Multiplier* is the number by which the *Multiplicand* is multiplied, and

The *Product* is the number which is produced by the multiplication of the *Multiplicand* and the *Multiplier* together.

Thus, if it were required to multiply 8 by 7, here 8 is the *Multiplicand*, 7 the *Multiplier*, and 56 is the *Product*, for 8 times 7, or 7 times 8, is 56.

In *Multiplication* it mattereth not which of the two numbers given is made the *Multiplicand*, or which the *Multiplier*, for the *Product* produced by either will be the same, but the usual and best way is to make the greater number the *Multiplicand*, and the lesser number the *Multiplier*, except one of the numbers have one or many Cyphers on the right hand thereof, as these and such like numbers, 700, 230, 9000, in such like numbers it will be best to make the greater number the *Multiplier*, and the lesser number the *Multiplicand*.

To perform the work of *Multiplication*, this is

The RULE.

The Numbers to be multiplied must be set one under another, viz. the Multiplicand (*or greater*

greater number) above, and the Multiplier *(or leſſer number) below, the laſt figure of the* Multiplier *under the laſt figure of the* Multiplicand; *Then draw a line under them, and (having learned the foregoing Table perfectly by heart) multiply every digit of the* Multiplier, *into every digit of the* Multiplicand, *ſetting the ſeveral Products under the line, then having finiſhed your Multiplication, draw a line, and add all the Products together, and the ſumme of thoſe Products is the general Product of the whole Multiplication, as by the following Examples will appear.*

Example 1. Let it be required to multiply 736 by 7, that is, let it be required to know how many dayes there are in 736 weeks; Firſt, I write down 736 the Multiplicand, and under it 7, the Multiplier, and under them I draw a line, then I multiply 7 into every digit of the Multiplicand, ſaying, 7 times 6 is 42, place 2 under the line under 7, and for the four tens keep 4 in mind, then ſay again, 7 times 3 is 21, and 4 which I kept in mind is 25, place 5 under the line, and keep the two

Weeks	
736	Multiplicand
7	Multiplier
——	
5152	Product
dayes	

two tens in mind, then say again, 7 times 7 is 49, and two which I kept in mind is 51, place 1 under the line, the 5 tens (because there is no more figures to be multiplied) I set down under the line also, so is the work ended, and the product of this multiplication is 5152, and so many dayes there are in 736 weeks.

Example 2. Let it be required to multiply 3417 by 5, as if it were demanded, How many shillings are there in 3417 Crowns? Place the numbers under one another, and draw a line under them as in the Example, then begin your Multiplication, saying, 5 times 7 is 35, place 5 under the line, and keep the three tens in mind, then say again, 5 times 1 is 5, and 3 which I kept in mind is 8, place 8 under the line, and

Crowns	3417	Multiplicand
	5	Multiplier
Shillings	17085	Product

(because it is less than 10, I keep nothing in mind) then say again, 5 times 4 is 20, place the cypher 0 under the line, and keep the two tens in mind; lastly, say 5 times 3 is 15, and 2 which I kept in mind is 17, which 17 being

being the laſt number I place under the line, and ſo my Multiplication is ended, and the Product is 17085, and ſo many ſhillings are there in 3417 Crowns.

Example 3. In the two foregoing Examples, the Multiplier conſiſted but of one digit, we will now ſhew how Multiplication is performed when the Multiplier conſiſts of more than one Figure, therefore in this Example, let it be required to multiply 5704 by 37, as if 5704 poor men were to have 37 ſhillings a man, how many ſhillings muſt there be to pay them?

5704	Multiplicand
37	Multiplier
39928	
17112	
211048	Product

Place your numbers, and draw a line under them, as you ſee in the Example, then begin your multiplication in this manner, ſaying, 7 times 4 is 28, ſet 8 under the line, and keep the two tens in mind, then ſay 7 times nothing is nothing, but the two tens in mind is 2, ſet 2 under the line, then ſay 7 times 7 is 49, ſet 9 under the line, and keep 4 in mind; then laſtly, ſay 7 times 5 is 35, and 4 in mind is 39, which being the laſt number to be multiplied I ſet down under the line, ſo is the multiplication

plication of one of the digits (namely 7) finished.

Then begin to multiply the second digit, saying 3 times 4 is 12, place 2 in the second line one place forwarder towards the left hand, and keep 1 in mind, then say three times nothing is nothing, but 1 in mind is 1, set down 1 by the 2 in the second line; thirdly, say 3 times 7 is 21, place 1 in the second line, and keep the two tens in mind; Lastly, say 3 times 5 is 15, and 2 in mind is 17, which 17 (because there is no more Figures to be multiplied) I place in the second line also.

Having thus done, I draw a line under them, and add these two lines together, as in common Addition or numbers of one denomination, saying 8 is 8, place 8 under the line, then say 2 and 2 is 4, place 4 under the line, then say 1 and 9 is 10, place a cypher under the line, and carry 1 to the next place, saying 1 and 1 is 2, and 9 is 11, place 1 under the line, and carry 1 to the next row, saying 1 and 7 is 8, and 3 is 11, place 1 under the line, and carry 1 to the next place, saying, 1 which I carry and 1 is 2, place 2 under the line, and so is your multiplication ended, and the Product is 211048. And so many shillings must be provided to pay 5704 poor men 37 shillings a piece.

Example:

Example 4. Let it be required to multiply 57325 by 4032, place the multiplicand and multiplier one under another, and draw a line as before, then proceed to the multiplication as formerly, ſaying, firſt, 2 times 5 is 10, ſet down a cypher and keep 1 in mind, then 2 times 2 is 4, and 1 in mind is 5, place 5 under the line, then 2 times 3 is 6, ſet 6 under the line; then 2 times 7 is 14, ſet down 4, and keep 1 in mind, then 2 times 5 is 10, and 1 in mind is 11, which 11 (being the laſt) I ſet down.

57325	Multiplicand
4032	Multiplier
114650	
171975	
2293000	
231134400	Product

The multiplication of one of the digits being finiſhed, proceed to the multiplication of the next, ſaying 3 times 5 is 15, ſet down 5 in the ſecond line one place more towards the left hand, and keep 1, then 3 times 2 is 6, and 1 kept is 7, ſet down 7, then 3 times 3 is 9, ſet down 9, then 3 times 7 is 21, ſet down 1 and keep 2 in mind, then 3 times 5 is 15, and 2 in mind is 17, which being the laſt ſet down alſo.

Two of the figures of the multiplier being finiſhed

finiſhed, proceed to the third, which (in this example) being a cypher, you may wholly neglect, and proceed to the multiplication of the fourth figure, only remember to remove the product of the fourth figure one place more to the left hand, as in the example you may ſee, for the cypher, which is in the Multiplier, I ſet a cypher under 7, for a cypher muſt keep his place, and the Figures following muſt be removed a place farther.

Then for the multiplication of the fourth and laſt digit, ſay 4 times 5 is 20, ſet down a cypher (under 9) and keep 2 in mind, then 4 times 2 is 8, and 2 in mind is 10, ſet down a cypher and keep 1 in mind, then 4 times 3 is 12, and 1 is 13, ſet down 3 and keep 1, then 4 times 7 is 28, and 1 kept is 29, ſet down 9 and keep 2, then 4 times 5 is 20, and 2 kept is 22, which 22 (becauſe the multiplication is ended) ſet down alſo.

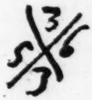
Having thus multiplied all the digits ſeverally, draw a line under their products, and add them all together as in the former example, ſo ſhall you find their general product to be 231134400.

Other

Other Examples for Practice.

```
       40326
        5432
       -----
       80652
      120978
      161304
     201630
   ---------
   219050832
```

```
       73580
       50032
      ------
      147160
      220740
   36790000
   ---------
  3681354560
```



Three brief Notes or Compendiums, *useful in Multiplication.*

1. If the Multiplier consist of cyphers in the last place or places, you may omit the multiplication of them, and place the former figures of the Multiplier under the Multiplicand, thus if it were required to multiply 3257 by 2600, place the numbers as you see in the margine, then multiplying 3257 by 26,

26, the Product will be 84682, to which if you add two cyphers (because there were two cyphers in the Multiplier) it will be 8468200, which is the true Product of the Multiplication.

3257
2600
19542
6514
8468200

2. If it be required to multiply any number by 10, 100, 1000, 10000, &c. You have no more to do but to add so many cyphers to the Multiplicand, as there are cyphers in the Multiplier, thus if you were to multiply 365 by 10, the Product will be 3650, or by 100, it would be 36500, or by 1000, it would be 365000, or by 10000, it would be 3650000, *&c.*

3. If any number given were to be multiplied by 5, you may abbreviate your work thus, add a cypher to the Multiplicand, take half that number, and it shall be the Product required, thus if it were required to multiply 8627 by 5, add a cypher to the multiplicand then it is 86270 the half whereof is 43135, which is the product required.

The proof of Multiplication.

The most certain proof of Multiplication is

is by Division, but becanſe diviſion is not yet taught, I will here ſhew a neer way by which Multiplication may be proved. Which is thus,

THE RULE.

Make a Croſſe as in the Margine, then any ſums being multiplied, you may prove the truth of your work in this manner, (1) *Caſt away all the nines which you can finde in the Multiplicand, what remaineth ſet on the right ſide of the Croſſe.* (2) *Caſt away alſo the nines in the Multiplier, and what remains ſet on the left ſide of the Croſs.* (3) *Multiply the figure on the right ſide of the Croſs by that on the left ſide of the Croſs, and out of that product caſt away the nines, ſetting the figure remaining over the Croſs, then* (4) *caſt away all the nines in the product; and if the figure remaining be the ſame with that which ſtandeth over the Croſs, then is your Multiplication truly performed, otherwiſe not.*

X

Example 1. Let it be required to prove the following Summe.

8 8

C 4324

```
 4324
   23
------
12972
86480
------
99452
```

```
    2
4   X   5
    2
```

1. Cast away all the nines in the Multiplicand, saying 4 and 3 is 7, and 2 is 9, which being rejected there remains 4, which I set on the right side of the crosse, then

2. Cast away all the nines in the Multiplier: saying 2 and 3 is 5, which being lesse then 9) I set on the left side of the cross, then

3. Multiply 4 by 5, saying 4 times 5 is 20 from which cast all the nines, and there remains 2, place 2 over the cross, and

4. Cast away all the nines in the Product, saying, 2 and 5 is 7, and 4 is 11, cast away 9, and there remains 2, which exactly agrees with the figure over the cross, and demonstrates that the multiplication is truly performed.

Many questions that appertain to the Rule of Three (commonly called the Golden Rule) may be performed by Multiplication only,

only, of which I will give you some Examples.

If 1 day be 24 hours, how many hours are 365 dayes?

	365	
	24	
	1460	
	730	
hours	8760	

If 1 li. be 20 sh. how many shillings is 2764 li.?

	2764
	20
shillings	55280

If 1 foot be 12 inches, how many inches in 2760 foot?

	2760
	12
	5520
	2760
inches	33120

If 1 Acre be 160 square Poles or Perches, how many Pole is 3698 Acres?

160
221880
3698
square Poles 591680

Infinite questions of this kind might be proposed, but let these suffice, and so I conclude Multiplication.

CHAP.

CHAP. V.

Of DIVISION.

WHat affinity *Multiplication* hath to *Addition*, the same hath *Division* to *Substraction*, for *Division* may be performed (but with much labor) by *Substraction*, as *Multiplication* might be by *Addition*. For *Multiplication* turns great denominations into smaller, and *Division* turnes smaller denominations into greater, as by Examples following will be made appear.

In Division three things are chiefly to be minded, namely.

1. The Dividend, or number to be divided, which is alwayes the greatest number of the Three :

2. The *Divisor*, which is that number by which the Dividend is to be divided.

3. The *Quotient*, which is the number produced by the dividing of the Dividend by the Divisor, and alwaies consists of so many

Unites as the *Divisor* may be taken out of the *Dividend.*

To perform Division there are several wayes, but that which is most usually practised in Schools is that which followeth; for the performance whereof, this is

THE RULE.

Place the Divisor *under the* Dividend, *so that the figures next to the left hand stand directly one under the other: having so placed them, try how many times the lower figures are contained in the upper figures, and write that figure which answereth the question within a crooked line in the margine of the work, which is called the* Quotient, *and by that figure multiply the first figure of the* Divisor, *and take the Product out of the figure directly over it, beginning the Substraction toward the left hand; then cancel that figure of the Divisor, and also, that of the Dividend which hath been already made use of, by giving it a light dash with a pen, and write the remain just over the figure cancelled: then proceed to do the like with the second, third, and fourth figure of the Divisor (if there be so many) till you have cancelled it all, and then have you finished our work.*

Now if the Dividend have still some figures untouched towards the right hand, then remove the Divisor still toward the right hand, but one place at a time, and then again ask (or try) how many times the lower may be had in the upper, and write the answer in the Quotient whether it be 1 or more, (only it cannot be above 9) and if it can be had never a time, then put 0 in the Quotient, then multiply the Divisor by this new figure, and substract the Product, setting the remainer orderly above, as before; this work must be repeated by removing the Divisor still one place towards the right hand, until you come to the last figure of the Divisor, and then the work is finished.

Example 1. Let it be required to divide 4096 by 3. As if 4096 shillings were given to be distributed to several poor people, each person to have 3 shillings, how many persons must there be? Place the numbers as here you see.

4096	(1
3	

Then ask how many times 3 in 4, the answer is Once, which put within a crooked line by it self, as here you see done.

Then, in your mind multiply the Divisor 3 by the quotient 1. And having said these

 words,

words, once 3 is 3, preſently cancel the 3. And having added theſe words, out of 4, cancel the 4. And after theſe words, and there remains 1, write one juſt over the 4, as you ſee here done.

1
~~4~~096 (1
~~3~~

Then remove the Diviſor one place towards the right hand, ſaying, how many times 3 in 10, the anſwer is, 3, write 3 in the quotient, and in your mind multiply the Diviſor 3 by the quotient 3, the product is 9, wherefore ſay three times three is nine, out of ten over head, and there remains one, then (having cancelled the 3 and the 10) write over them 1.

~~1~~ 1
~~40~~96 (13
~~33~~

Again, remove the Diviſor 3, one place more, asking how many times 3 in 19? the anſwer being 6, write 6 in the quotient, and ſay 6 times 3 is 18 out of 19, and there remains 1, wherefore having cancelled the 3, and the 19, write 1 over 9, and remove the Deviſor once more,

~~11~~ 1
~~409~~6 (136
~~333~~

and ask *how many times* 3 *in* 16? answer is 5, which write in the quotient, then in mind say 5 times 3 is 15 out of

~~xxx~~ 1	
~~4096~~	(1365
~~3333~~	

16, and there remains 1, and cancelling the 16 and the 3, write 1 over 6. Now because the Divisor 3 is advanced so far till it is come to stand under 6 in the Dividend, which 6 is the last Figure there, the Divisor cannot be removed any more, and therefore the Division is ended, and the quotient being 1365, shews that the Divisor 3 is contained in the Dividend 4096, 1365 times; and 1 remaining, which 1 being less than the Divisor 3. doth not contain it once, but one third part of once, which sheweth there must be 1365 persons, and then there will be one shilling over. The proof of Division is by multiplying the quotient into the Divisor, and to the product add the remain; then if the work be well done, the sum shall be equall to the Dividend.

So 1365 the quotient, multiplied by 3 produceth 4095, to which adding the remain 1, the summ 4096 is equal to the Dividend, which proveth the work to be true.

Here we divided onely by one figure, whereof we will take another Example, to make the work easie and clear, and to be a

fair introduction to the multiplying by more figures than one.

Example 2. Suppose the same 4096 were to have been divided by 8, that is, every poor person were to have 8 shillings, how many persons must there then be?

The work must have stood thus, namely; the 8 must not have stood under the 4, as the 3 did in the former Example but under the 0, because 8 is greater then 4, and cannot therefore be taken out of it, therefore you must see how many times 8 you can have in 40, which you may have 5 times, set 5 in the quotient, then how many times 8 in 9, once and 1 remain, set 1 in the quotient, and 1 over 9, then how many times 8 in 16 twice, set 2 in the quotient and there remains nothing, so the quotient is 512 (which is one place less) and so many poor persons must there be, and no shillings remaining.

```
  1
4096 (512
 888
```

Example 3. Let it be required to divide 1310720 by 4096, as if one vessel of Wine should contain 4096 Pints, how many such vessels would 1310720 pints fill?

Place

1310720(
4096

Place your numbers as here you see, and ask how many times 4096 is there in 13107? to find an answer to this Question immediately, to a learner would be hard, let him therefore ask how many times 4 can he have in 13, which he can readily do, and say three times, then put 3 in the quotient, and say 3 times 4 is 12, which substract out of 13 over it, saying 2 out of 3, and there remains 1, and 1 out of 1 and there remains 0, cancelling the 4 and 13, and set the remain 1 over the 4, as you see.

1
~~1~~ 8 ~~3~~ 9
~~1~~ ~~3~~ ~~1~~ ~~0~~ ~~7~~ 20 (3
~~4~~ ~~0~~ ~~9~~ ~~6~~

Then go on saying, 3 times 0 is 0, out of 11, and remains still 11, again, 3 times 9 is 27, take 7 out of 10 there remains 3, to be set over the 0, which is over 9, and 2 with 1 borrowed (to make the 0, 10, from the which the 7 was taken) is 3, and 3 out of 11, remains 8, which write over the place of 0 in the Divisor, cancelling the 9 in it, and also those figures of the Dividend 110 out of which you have taken any thing; lastly, say 3 times 6 is 18, take 8 out of 7 I cannot,

therefore (borrowing 10) say 8 out of 17 remains 9, which write over the 7, then in the next place, the 10 borrowed is 1, and the 10 in the 18 is 1 more; Say therefore 1 and 1 is 2, out of 3, and the remain is 1, which write over the 3, having still cancelled the figures which you have used orderly as you go.

Now the whole Divisor being cancelled, it must be removed on one place further, and placed as here. Then ask how many times 4096 in 8192? it will be found (because of the 0 after the 4) as often as 4 in 8, that is 2 times, put therefore in the quotient 2, and work

```
      0 0
      1 1
    0 1 8 3 9 0
  1 3 1 0 7 2 0 (320
    4 0 9 6 6 6
      4 0 9 9
        4 0
```

as before, saying 2 times 4 is 8, out of 8 remains 0, then 2 times 0 is 0, out of 1 remains 1, then 2 times 9 is 18, take 8 out of 9 remains 1, (which put over the 9), and 1 out of 1 in the next place remains 0, then lastly, 2 times 6 is 12, that is 2 out of 2 there remains 0, and 1 out of 1, there also remains 0, cancell and put the remainder over as formerly.

Now again, the Divisor being all cancelled,

led, should be removed; and ask how many times 4096 in 0000, the answer is 0, which being put in the quotient, the work is done.

And the quotient 320, shews that the Divisor 4096 is contained in the Dividend 1310720, three hundred and twenty times; and so many Vessels, each of which contains 4096 pints, will 1310720 pints fill.

And whether the Divisor have 2, 3, 5, 7, or more places, the working is still like this, not differing from it at all.

Brief wayes or Compendiums in Division.

As in Multiplication, so in Division there are brief Rules, as if the Divisor have one or more cyphers towards the right hand, those cyphers may be placed orderly under the last figure or figures of the Dividend, and remain there till the work be done, which will much shorten it.

As if 2587645 were to be divided by 15000, place them thus,

2587645	(
15 000	

And say how many times 15 in 25? answer is 1, which write in the quotient, and multiply in mind the divisor by the quotient, saying once one is one, out of 2 there remains 1, then

then cancel the 2, and the 1 under it, and write the remaining 1 over it, as here is done, then ſay once 5 is 5 out of 5, and there remains o, therefore cancel the two fives, and over the uppermoſt write o, then will the work ſtand thus:

```
  10
2587645 (1
15    00
```

Now remove the diviſor one place, and ask how many times 15 in 108? anſwer is 7, which write in the quotient, and multiply, ſaying 7 times 1 is 7, out of 10 remains 3, which write over the o, then ſay 7 times 5 is 35, take 5 out of 8 remains 3, which write over 8, and 3 out of 3 remains o, then will the work ſtand thus:

```
  3
 103
2587645 (17
155 090
 1
```

Now again, remove the diviſor, and ask how many times 15 in 37? anſwer is 2, which write in the quotient, and ſay 2 times 15 is 30, out of 37 remains 7, and the Diviſion is ended, the remainin being 7645, and the whole work finiſhed will ſtand as followeth:

```
  00
  31
 1037
2587645 (172
1555000
 11
```

Proof

Proof of this.

Multiply the quotient	172
by the Divisor	15
	860
	172
The Product	2580

Before which put the three cyphers, and then it is 2580000

To which add the remain 7645

The total is 2587645

Which is equal to the Dividend, and therefore the work is right.

So if one would divide any sum by 10, 100 1000, 10000, *&c.* he need but cut off the first, two first, three first, or four first figures towards the right hand, the other figures shall be the quotient, and those cut off the remain.

As if 1587645 be divided by 1000, the quotient is 1587, and the remain 645.

As many questions appertaining to the *Rule of Three* may be performed by *Multiplication* only, so may divers be by *Division* only, but all in general of that Rule by *Multiplication* and *Division* joyntly, as when we come

come to that Rule will appear. In the mean time I would give you only four, which shall be just the converse of those I gave you in *Multiplication*.

If 365 dayes be 8760 hours, how many hours in one day ?

2
14
252
8760 (24 hours
3655
36

If 55280 shillings be 2764 pounds, how many shillings is in one pound ?

11
55280 (20 shillings
27644
276

If 2760 foot be 33120 inches, how many inches is one foot ?

1
51
1650
33120 (12 inches
27600
276

If 3698 Acres contain 591680 square Perches, how many Perches are in one Acre?

48
214
2328
591680 (160 Perches.
369888
3699
36

Another way of Division, which is more easie than the former, and without cancelling any figure, and is proved by Addition.

THere is another kind of Division which is very much used, and is in most request with those who have most occasion to divide great numbers, the manner of working it is not difficult, for one or two

examples will make it plain.

Example 1. Let it be required to divide 162483 by 1321, set down your numbers as you see them placed in the margine, *viz.* First, set down 162483 the Dividend, then on the left hand thereof set the Divisor 1321 with a crooked line between them, then on the right hand thereof make another crooked line which must serve to set the figures of the quotient in, so are your numbers placed in due order, then draw a line under the Dividend, and make a prick under the figure 4, because so far the figures of the Divisor would extend if they had been placed underneath the Dividend, according as in the other Examples, this prick serves only to shew now far you have proceeded in your work, and must at every Division be removed a place further, till at length you come to the last figure of the Dividend: your numbers being thus placed with a line under them, you are ready for the work, which must be performed according to the directions of the following Rule.

1321) 162483(

THE

THE RULE.

Demand how often the Divisor may be had in the Dividend, and place that number in the quotient, then multiply the Divisor by the quotient, and place the product under the line: then substract this product from the Dividend and set the remainder under the product, then make a prick under the next figure of the Dividend, and bring that figure down to the remainder, and then proceed as before.

Example, Your numbers being placed as is before directed, you may begin your work in this manner, first, say how many times 1321 can I have in 1624, say once place 1 in the quotient, by which I multiply the Divisor 1321, beginning at the left hand, saying, once one is 1, place 1 under the line & under the first Prick, then once 2 is 2, set 2 under the line, then once 3 is 3, place 3 under the line, lastly, once 1 is 1, place 1 under the line, then

```
1321) 162483 (123
      ------
      1321
       3038
      ------
       2642
        3963
      ------
        3963
        0000
```

substract

ſubſtract this 1321, from 1624 which is over it, and there will remain 303, to this 303 bring down the next figure in the Dividend, namely 8, under which make a prick, ſo will that number be 3038, under which draw a line, and repeat the ſame work again, ſaying, how many times 1321 can I have in 3038, which may be had 2 times, place 2 in the quotient, by which 2 multiply the Diviſor 1321, ſaying 2 times 1 is 2, place 2 under the line; then 2 times 2 is 4, place 4 under the line; then 2 times 3 is 6, place 6 under the line; laſtly, 2 times 1 is 2, place 2 under the line, and ſubſtract this 2642 from 3038, and there will remain 396, to this 396 bring down the next figure of the Dividend, which is 3, ſo is this number made 3963, under which draw a line, and repeat the work once again, ſaying, how many times 1321 can I have in 3963, which may be had 3 times, by which 3 multiply the Diviſor 1321, ſaying 3 times 1 is 3, then 3 times 2 is 6, then 3 times 3 is 9, and laſtly, 3 times 1 is 3, which place under the line, and ſubſtract it from the line above, which in this example is the ſame number, therefore there remains nothing; and the work is ended; but if any remainder had been, that ſhould have been ſet under the line, as by the Examples following will make appear.

Another

Another Example for Practice.

```
5624) 793058 (141
        ...
      ———————
      5624
      23065
      ———————
      22496
        5698
        ———————
        5624
          74 remains.
```

In this Example where 793058 is divided by 5624, you may perceive that the quotient is 141, and 74 remaining.

The Proof of this Division.

This kind of Division is proved by Addition, for, *If you add the several Products arising from the Multiplication of the several quotients into the Divisor, and also add thereunto the remainder (if any be) the total of this Addition shall be equal to the Dividend, if there be no error in the work.*

So in the Example following, where 76321 is divided by 4325, if you add 4325 the first Product, and 30275.

4325) 76321 (17

1 Proudct	4325
	33071
2 Product	30275
	2796 *remain*
	76321 *Proof.*

the ſecond Product, and 2796 the remainder together, in the ſame order as they now ſtand in the Example, you ſhall find the total of this Addition to be 76321, equal to the Dividend, which demonſtrates the work to be true. And thus much concerning Diviſion.

Another Example of this kind of Diviſion proved.

2643) 7685904 (2908

1 Product	5286
	23999
2 Product	23787
	21204
3 Product	21144
Remainder	60
Proof.	7685904

CHAP.

CHAP. IV.

Of REDUCTION.

REDUCTION cannot properly be termed any real Rule of Arithmetick, but rather the Application, Use, or Proof of Multiplication and Division, but those that have written of it (as many do not mind it) do give it this definition.

To Reduce is to convert or change any number from one Denomination *to another, as sometimes from lesser to greater, and sometimes from greater to lesser.*

By which, Coins, Weights, and Measures may be reduced from one denomination to another, as from their *greater* terms to *lesser*, & from their *lesser* to their *greater*.

By this Rule you may reduce the Coins, Weights and Measures of one Country, into the Coins, Weights and Measures of another Country. For the working or performing whereof, this is,

A general Rule.

Any greater denomination is turned into

a lesser by *Multiplication*, and any lesser denomination is turned into a greater by *Division*.

1. To bring therefore a *greater* denomination into a *lesser*, you must first consider how many of the *lesser* make one of the greater, and by that number you must alwayes *Multiply*.

2. To bring a *lesser* denomination into a greater, you must consider how many of the *lesser* make one of the *greater*, and by that number you must alwayes *divide*.

The denominations of English money are *Pounds*, *Shillings*, *Pence*, and *Farthings*, of which, four *Farthings* make one *Peny*, 12 *Pence* one *Shilling*, and 20 *Shillings* make one *Pound*; Therefore,

To bring	Pounds into Shillings	multiply by	20
	Shillings into Pence		12
	Pence into Farthings		4

To bring	Shillings into Pounds	divide by	20
	Pence into Shillings		12
	Farthings into Pence		4

In

These two Questions are the converse of each other, and do prove each other, and so likewise do all those which follow.

In 567 lib. how many shillings? multiply 567 by 20.

567
20
11340

In 11340 s. how many pounds? divide 11340 by 20.

~~111~~
~~11~~~~3~~4~~0~~ (567 *li.*
~~2220~~

In 532 lib. 6 s. 5 d. 3 q. how many farthings?

Multiply 532 by 20, it makes 10640, to which add the 6 shillings, it is 10646 shillings, that multiplied by 12 makes 127752, to which add the 5 pence, it is 127757 pence, that multiplied by 4, and the 3 farthings added makes 511031.

I

l.	s.	d.	q.
532	6	5	3

```
  532
   20
-----
10640
    6
-----
10646 shillings
   12
-----
21292
10646
------
127752
     5
127757 pence
     4
------
511028
     3
------
511031 farthings.
```

* I needed not here have made a line, and set down the 6 odd shillings by it self, neither the 5 odd pence, nor the 3 odd farthings: but have added them in the work with the other figures. As in multiplying 432 by 20, I might have

have said 2 times 0 is 0, but 6 is 6. Likewise in multiplying 10646 by 12, I might have said 2 times 6 is 12, and 5 is 17, set down 7 and carry 1. Also in multiplying 127757 by 4, I might have said 4 times 7 is 28, and 3 is 31, set down 1 and carry 3; then would the work have stood as in this Example following.

l.	*s.*	*d.*	*q.*
532	6	5	3

```
      20
 ---------
 10646 shillings
      12
 ---------
  21297
 10646
 ---------
 127757 pence
       4
 ---------
 511031 farthings.
```

In 511031 farthings, how many pounds, shillings and pence?

Divide 511031 farthings by 4, and it makes 127757 pence and 3 farthings, that divided by 12, it gives 10646 shil. and 5 pence, that divided by 20 gives 532. So that in 511031 farthings, there are 532 *l.*

 6 *s.*

6 *s.* 5 *d.* 3 *q.* as by the work following you may perceive.

```
          11
13323  (39157  (5d.    (6s.
511031 (127757 (10646 (532l.
444444  1222222  2220
          1111
```

I have been the larger in this Example, because I intend more brevity in those which follow.

In 16 *l.* 12 *s.* 0 *d.* 1 *q.* how many farthings?

```
     l.        s.     d.    q.
     16        12     0     1
      20
    -----
     332 shillings
      12
    ------
     664
    332
    ------
    3984 pence
       4
    ------
   15937 farthings.
```

In

In 15937 farthings, how many pounds, shillings, pence and farthings?

33x (1 q. 3z (0 d. 4 (1 s.
x5937 (3984 (33 (2 (16 l.
4444 xxxz zz0
xx

But to reduce shillings into pounds, there is a nearer way, by cutting off the last figure towards your right hand, and taking half the other number which will be pounds, and the figure cut off will be shillings. So 76534 shil. will be 3826 pounds 14 shillings, as by the work appeareth

1
7653|4
———
3826 l. 14 s.

In halving of any sum, if 1 remains (as here) it signifieth 10 s. and is to be added to the last figure cut off.

Reduction of Troy weight.

The denominations of Troy weight are pounds, ounces, penny weights and grains, of which

24 Grains	make	1 Penny weight,
20 Penny-weight		One Ounce,
12 Ounces		One pound.

Therefore,

To bring	Pounds into Ounces	multi-ply by	12
	Ounces into Peny-weight		20
	Peny-weights into grains		24

To bring	Ounces into Pounds	Divide by	12
	Peny-weights into ounce		20
	Grains into peny weights		24

In 26 pounds, 10 ounces, 12 peny weight, 6 grains, how many grains?

l.	*Oun.*	*p.w.*	*gr.*
26	10	12	6

```
    26
    12
  ----
    52
    27
  ----
   322 Ounces
    20
  ----
  6452 Peny-weights
    24
  ----
  25814
 12904
 ------
 154854 Grains.
```

In

In 154854 Grains, how many Pounds, Ounces, Peny-weights and Grains?

```
   x                          (1
  xz                          x
  3ðxxx(6      (1             x8 (0
 x54854 (645 (2   (3zz (26 l.
  z4444    zzz  0      xxx
   zzz                  x
```

	l.	Oun.	p.w.	Gr.
Ans.	26	10	12	6

Reduction of Avoirdupois Weight.

The denominations of this Weight are Hundreds, Quarters, Pounds and Ounces, of which

16 Ounces	make	One Pound,
28 Pound		One Quarter,
4 Quarters		One C. weight.

Therefore,

To bring	Hundreds into Quarters	multiply	4
	Quarters into Pounds		28
	Pounds into Ounces.		16

To bring	Quarters into Hundreds	divide by	4
	Pounds into Quarters		28
	Ounces into Pounds		16

In 5652 hund. 2 quarters, 19 pounds, and 6 ounces Avoirdupois weight, how many ounces?

	C.	Q.	l.	Ou.
	5652	2	19	6

```
          4
       ------
       22610  Quarters.
          28
       ------
      180899
      45220
      ------
      633099  Pounds.
          16
      ------
     3798600
     633099
     -------
    10129590  Ounces.
```

In 10129590 Ounces, how many hundred, quarters, pounds and ounces?

```
                    x
 2x  x2         38
454x65(6    8776(1    22x(2
x0x29590(633099(9(22610(5652
 x66666   x8888     444
  xxxxx   2222
```

C.

	C.	Q.	L.	Ou.
Ans.	5652	2	19	6

Reduction of Time.

Time is measured by Years, Dayes, Hours and Minutes, whereof

60 minutes	make	one hour,
24 hours		one day,
365 dayes		one year.

Therefore,

To bring	Years into Dayes	multiply by	365
	Dayes into Hours		24
	Hours into Minutes		60

To bring	Dayes into Years	divide by	365
	Hours into Dayes		24
	Minutes into Hours		60

In 124 years, 236 dayes, 9 hours and 63 minutes, how many minutes?

ye.	da.	ho.	m.
124	236	9	6

```
      124
      365
     ----
      626
     747
    374
   ------
    45496 dayes.
       24
   ------
   181993
   90992
  -------
  1091913 hours.
       60
  -------
 65514786 minutes.
```

In 65514786 minutes, how many years, dayes, hours and minutes?

```
                                      (2
                                      x4
                          x           x6
                       xxx93          87(3
   x5     x            z3335(9        x995
655x478(6(x09x9x3(4549(6(124.ye.
56666666 0  z44444    35555
               xzxz       366
                            3
```

Ans. 124 *ye.* 236 *ds.* 9 *ho.* 6 *m.*

Reduction of Wine-Measure.

The Denominations of Wine-Measure are Tuns, Hogsheads, Gallons, Pottles, Quarts and Pints: of which

2 Pints	make one	Quart
2 Quarts		Pottle
2 Pottles		Galon
63 Galons		Hogshead
4 Hogsheads		Tun.

Therefore,

To bring	Tuns into Hogsheads	multi-ply by	4
	Hogsheads into Galons		63
	Galons into Pottles		2
	Pottles into Quarts		2
	Quarts into Pints		2

In

To bring	Hogsheads into Tuns	divide by	4
	Galons into Hogsheads		63
	Pottles into Galons		2
	Quarts into Pottles		2
	Pints into Quarts.		2

In 26 Tuns, 3 Hogsheads, 8 Galons, 1 Pottle, 1 Quart and 1 Pint, how many Pints?

Tun.	*hogs.*	*gal.*	*pot.*	*qu.*	*pint.*
26	3	8	1	1	1

4

107 Hogsheads
63

329
642

6749 Galons
2

13499 Pottles
2

26999 Quarts
2

53999 Pints.

Tun

In 53999 pints, how many Tuns, Hogs-heads, Galons, &c.

```
xxxxx(1    xx(1
53999   (26999    (13499
22222    22222

 x x(1       42(8       2(3
13499    (6749     (107 (26
 2222       6333     44
            66
```

	Tun.	*Hosg.*	*Gal.*	*Pot.*	*Qu.*	*Pint.*
Ans.	26	3	8	1	1	1

CHAP.

CHAP. VII.

The RULE *of* THREE *Direct.*
Commonly called
The GOLDEN RULE.

OF all the Rules in Vulgar Arithmetick, this is the chief, though it wholly depends upon the two Rules before taught, *viz.* *Multiplication*, and *Division.* And of this Rule, the most which follow do participate, for it teacheth how, by having three numbers given, to find a fourth, which shall be in proportion to them.

Of this Rule there are two kinds, the one called the *Forward* or *Direct* Rule, the other the *Reverse* or *Backward* Rule of Three, in either of which, three things or Numbers are given, to find a fourth.

To work the forward or direct Rule of Three, these things are to be considered.

First, That the first and third of the numbers given, be both of one denomination or name. As for example; if your first number be *Pounds*, and your third number be *Pounds* also, then they be both of one denomination; but if your first be *Ells*, and your third number

any thing elſe but *Ells*, (as *Yards* or the like) then they are of different denominations, but [by *Reduction*] muſt be brought into one denomination; as if your firſt number be Ells, and your third number Yards, you muſt firſt turn your ells into quarters, and then your yards into quarters alſo, and then your firſt and third number will be both quarters, and ſo of one denomination.

Secondly, That of what name or denomination your ſecond number is, of the ſame denomination muſt the fourth number (which is that you ſeek) be of alſo; as if the ſecond be *Pounds*, the fourth muſt be *Pounds* alſo; if the ſecond be *Yards*, the fourth muſt be *Yards* alſo.

Thirdly, That in this Rule direct you muſt multiply the ſecond and third terms or numbers together, and the product of them you muſt divide by the firſt, the quotient of which diviſion will be the fourth number required, and be of the ſame denomination with the ſecond number given. To perform which work, this is

The RULE.

Multiply the ſecond term [*or number*] *by the third, and divide the product by the firſt;* *the*

the quotient shall be the fourth number desired.

In the working of this Rule, the chief thing is to know how to place the three numbers aright, when they are promiscuously or confusedly given; but by what hath been said already, you may remember that two of them are alwayes of one denomination, as both pounds, or both ells, or both yards or feet, &c. and the other number hath another denomination, and this single denomination is ever the second number in order; and one of the other two, namely, that which hath some relation to this second, is the first; and the other is the third number, whose relation is sought for in the fourth, whence it's plain, that the second and fourth are also of the same denomination.

Thus having premised these things, let us now exemplifie the Rule in some Questions.

Question 1.

If 6 yards of cloth cost 8 *lib.* what shall 42 yards cost?

Set the numbers in order as in the example following, If 6 yards cost 8 *lib.* what 42 yards? Here you see that the first number and the third number are both of one denomination,

mination, *viz.* both *yards*, and the second number is of another denomination, namely *Pounds*, wherefore the fourth number, which is sought for, must be also *Pounds*; therefore multiplying the second number by the third, and dividing the product by the first, the quotient shall answer the question.

First, 42 multiplied by 8 produceth 336, which divided by 6 (the first number) the quotient is 56 *lib.* and so much shall 42 yards cost. Your work being finished, it will stand thus:

	Yards		*Pounds*		*Yards?*
If	6	cost	8	what	42
					8
					336

3
336 (56
66

Question 2.

If 2 Ells cost 16 *l.* what are 537 Ells worth?

Place

	Ells	*lib.*	*Ells*
Place your numbers as here you see; then multiply 537 by 16 (that is, the second number by the third) and the product is 8592	2	16	537
			16
			3222
			537
			8592

xx
8592 (4296 *lib.*
2222

Which divided by 2 (the first number) the quotient is 4296, which is 4296 *l.* and so much are 537 ells worth.

Question 31.

If 20 sheep cost 13 pound, 13 shillings 4 pence, what is that a piece?

Turn the shillings and pounds into pence by Reduction thus:

sh.

sh.	*l.*
13	13
12	240
26	520
13	26
156	3120
	156
	4
	3280

Multiply 13 *s.* by 12, the product is	156
And 13 *l.* by 240 (because 240 *d.* maketh 1 *l.*) the product is	3120
To which add the 4 *d.*	4
It makes in all	3280

Then the Question will be, If 20 sheep cost 3280 *d.* what shall one sheep cost?

	sheep		*pence*		*sheep*
If	20	cost	3280	what	1

x d.

x d. 4 (8 s.

3280 164 x64 (13

2220 x22

x

By the Rule before delivered, I should multiply

multiply the second number by the third, but in this example, the third number being 1, it doth not multiply; I therefore divide 3280 the second number, by 20 the first number, and the quotient 164, is the price of one sheep in pence, which divided by 12, the quotient is 13 *s.* and 8 d. remaining, the price of every single sheep therefore is 13 *s.* 8 *d.*

Question 4.

If 100 *l.* give 6 *l.* Interest for a year, how much shall 750 *l.* give?

Multiply 750 by 6, the product is 4500, which divided by 100, the quotient is 45 *l.* for the thing required.

	li.		*li.*		*li.*
If	100	give	6	what	750
					6
					4500

4500 (45 *l.*
1100

Question 5.

If 750 *l.* give 45 *l.* interest for a year, what shall 100 *l.* give?

Multiply

Multiply 45 by 100 the product is 4500, which divided by 750, the quotient is 6 *l.* for the interest of 100 *l.* for a year.

	li.		*li.*		*li.*
If	750	give	45	what	100
			100		
			4500		

3
4500 (6 *l.*
750

Many other questions might be added, but the Rule is so plain that it needs them not; and so general, that he which can resolve one, may aswell resolve any other. However, I have here added other Examples for the Learner to practise by.

If 25 Yards of Cloth cost 9 *l.* 12 *s.* what are 27 ells worth?

	yards		*li.*	*s.*		*yards.*
If	25	cost	9	12	what	27
			20			
			192			

If 15 Ells of Cloth cost 7 li. 10 s. what shall 27 Ells cost?

Ells	*l.*	*s.*	*Ells*
15	7	10	27

```
    7
   20
  ----
  150
   27
  ----
 1050
 300
 ----
 4050   13
        20        1
        4050  (27 | 0 s. or
        1555     13 l. 10 s.
         11
```

If 27 Ells cost 13 *l.* 10 *s.* what will 15 ells cost?

Ells	*l.*	*s.*	*Ells*
27	13	10	15

```
    13
    20
   ----
   270
    15
   ----
  1350
  270
  ----
  4050
```

```
x
23          1
4050   (15|0
2777    7 l. 10 s.
22
```

If 27 Ells cost 13 *l.* 10 *s.* how many ells shall I have for 7 *l.* 10 *s*?

l.	*s.*	*Ells*	*l.*	*s.*
13	10	27	7	10
20		7		
270			150	
			27	
			1050	
			300	
			4050	

```
23
23
4050 (15
2700
27
```

If I sell 15 Ells for 17 *l.* 10 *s.* how many ells shall I sell for 13 *l.* 10 *s.*

l. s.

l.	*s.*	*Ells*	*l.*	*s.*
7	10	15	13	10
20			20	
150			270	
			15	
			1350	
			260	
			4050	

~~13~~
~~20~~
~~4050~~ (27
~~1500~~
~~15~~

If 4 pounds cost 1 *s.* 5 *d.* what will 8765 pound cost?

lib.	*s.*	*d.*	*lib.*
4.	1	5	8765
	12		17
	17		61355
			8765
			149005

xxx

221 (1   1 (3
149005   37251 (3104 (155
44444   12222
111

Ans. 155 *l.* 4 *s.* 3 $\frac{1}{4}$ *d.*

If 15 Ells cost 7 *l.* 10 *s.* what are 27 $\frac{1}{2}$ ells worth?

Here because there are half ells in the Question, you must therefore turn your 15 Ells into halves, by multiplying them by 2, and they make 30 half ells, also you must turn your 27 ells and a half, into halves, and they make 55 half ells: then will the work stand as here you see.

Ells	*l.*	*s.*	*Ells*
15	7	10	27$\frac{1}{2}$
2	20		2
30	150		55
	55		
	750		
	750		
	8250		

```
 11        1
 8250   (27|5
 3000    13
  33
```

Ans. 13 *lib.* 15 *sh.*

If 27 ells and ½ cost 13 *l.* 15 *s.* what be 15 ells worth?

Ells	l.	s.	Ells
27½	13	15	15
2	20		2
55	275		30

```
        275
         30
       8250
       11
       37        1
       8250   (15|0
       5555    7
        55
```

CHAP.

CHAP. VIII.

The RULE *of* THREE, *Reverse.* Or, The Backward *GOLDEN RULE.*

SOme there are that make no difference between the *Direct* and the *Reverse Rule* of *Three*, but only in stating of the Question, and placing of the Numbers: But as in the *Direct Rule* you multiplied the second and third numbers together, and divided the product by the first: in this *Reverse Rule* you must

Multiply the First Number by the second, and divide the product by the third, the quotient shall be the Fourth Number required, and be (as in the Direct Rule) of the same Denomination with the second Number.

Objection.

But here it may be questioned, How shall I know when a Question is propounded, whether it must be wrought by the *forward* or the *backward* Rule?

Answer.

This General Rule is to be observed, *If* more *require* more, *or if* less *require* less, *the Question must be wrought by the* forward *Rule.* But, *If* more *require* less, *or* less *require* more

more then must you use the reverse *or* backward *Rule.*

The Examples following will make this plain.

Question.

If 24 Pioneers require 16 moneths to dig a Trench or Ditch about a City, how many Pioneers must there be employed to dig the like Trench or Ditch in 4 Moneths time?

Here 24 is not the first number, though it be first named; but the three numbers placed in order, stand thus:

16 24 4

For the middle term must alwayes be of the same denomination with that which is required, as in the Rule of Three Direct.

Now multiply 24 by 16, the product is 384, which divided by 4, the quotient is *96*, and so many Pioneers must be employed to dig the Trench in four Moneths.

Mon.	*Men*	*Moneths*
16	24	4
	16	
	144	x
	24	384 (96
	384	44

For if 16 moneths require 24 men; then (a fourth part of 16, which is) 4 moneths ſhall require (four times 24, that is) 96 men.

For here, *leſſe* requires *more*, that is, *leſſe time, more hands*; and therefore is it wrought by the *reverſe Rule*.

Queſtion 2.

If 1 Cloſe would graze 21 horſes for 6 weeks, how many horſes would it feed for 7 weeks?

Multiply 21 by 6 it produceth 126, which divided by 7, the quotient is 18. At that rate therefore it would keep 18 horſes for 7 weeks,

Weeks	*Horſes*	*Weeks.*
6	21	7
	6	
	126	

5
~~126~~ (18
77

Queſtion 3.

If one Cloſe will feed 18 horſes for 7 weeks, how long ſhall it feed 63 horſes?

Multiply (according to the Rule) 18 by 7, the product is 126, which divided by 63, the quotient is 2, therefore two weeks it ſhall keep them,

Horses	*Weeks*	*Horses*
18	7	63
7		
126		126 (2
		63

This Rule serves indifferently for hay, oats, or any other provision for Man or Beast, which may be of use in Garrisons, and such like cases where scarcity may be feared, to proportion either the *mouths* to the *meat*, or the *meat* to the *mouths*.

I will say no more of this Rule, onely give you three or four Examples for practice.

Other Examples for Practice.

One lent his Friend 400 *l.* without interest for 7 moneths; the Question is, how much he ought to lend him for twelve moneths, to requite his courtesie?

Moneths	*lib.*	*Moneths*
7	400	12
	7	
	2800	

```
 xx
 44(4      l.   s.   d.
x800 (233  6    8
xxxx
 xx
```

One lent his Friend 233 *l.* 6. *s.* 8 *d.* for 12 moneths without interest, upon condition he should upon occasion do him the like pleasure; the Question is, how much he ought to lend for 7 moneths to requite his courtesie?

Moneths	*l.*	*s.*	*d.*	*Moneths*
12	233	6	8	7

```
   20
 ------
  4666
    12
 ------
  9340
 4666
 ------
 56000
    12
 ------
112000
56000
 ------
672000
```

```
 4         2
672000  (96000  (800|0
 77777   22222
           222
```

Anſ. 400 *lib.*

One lent his Friend 400 *l.* for 7 moneths, upon condition that he ſhould do the like for him; but when he came to borrow of him, he could lend him but 233 *l.* 6 *s.* 8 *d.* how long ought he to keep it to ſave himſelf harmleſs?

l.	*Moneth*	*l.*	*s.*	*d.*
400	7	233	6	8
20		20		
8000		4666		
12		12		
16000		9340		
8000		4666		
96000		56000		
7				
672000				

x
xx
672000 (12 *Moneths*
560000
5600

One lent his Friend 233 *l.* 6 *s.* 8 *d.* for 12 moneths, how long ought he to lend him 400 *l.* to save him harmless?

l.	*s.*	*d.*	*Moneths*	*l.*
233	6	8	12	400
20				20
4666				8000
12				12
9340				16000
4666				8000
56000				96000
12				
112000				
56000				
672000				

4
672000 (7 *Moneths.*
96000

CHAP. IX.

The *Golden Rule*, compounded of five Numbers: Commonly called, *The Double RULE of THREE.*

THis Rule is an abbreviation of the common Rule of Three Numbers, for that it performeth that at one working, which the other Rule of Three effecteth at twice.

When any question appertaining to this Rule is proposed, you must first dispose the five Numbers in such sort, that the *second* number and the *fifth* be of the same denomination, and that the *third* or *middle* number of the five, be of the same denomination with that which is sought.

The Numbers being thus disposed, you must work by this following Direction.

THE RULE.

Multiply the first and second Numbers together, the product of them shall be your Divisor. *Again, multiply the three last Numbers one by another, (that is) the third by the fourth, and the fourth by the fifth, that last product*

product shall be your Dividend; *and the Number produced by that Division shall answer the Question, and be of the same denomination with the third, or middle, Number.*

Question 1.

If 6 men in 2 weeks build 23 Rod of wall, how many Rod will 24 men build in 12 weeks?

First place your Numbers as here is done, where you may see that the second Number and the fifth are of the same denomination, *viz.* both *Weeks*, and that the third or middle Number is *Roods*, of which denomination must the Number sought be.

Men

Men	*Weeks*	*Rod*	*Men*	*Weeks*
6	2	23	24	12

```
        2             24
        6             23
      ----          ------
       12             72
                     48
                    -----
                     552
                      12
                    -----
                    1104
                    552
                    -----
   x                6624
  x6
  6624 (552 Rod
  x222
   xx
```

Your Numbers being placed as you here see, multiply 6 by 2, it makes 12 for your Divisor. Then multiply 23 by 24, and it maketh 552, that again multiplied by 12, (the fifth Number) produceth 6624 for your Dividend.

Lastly, Divide 6624 by 12, and the Quotient will be 552; and so many Rod of the like wall will 24 men build in 12 weeks.

Question

Question 2.

If a Hundred weight (that is, 112 *lib.* weight) carried 120 miles, cost 14 *s.* how much shall three quarters of a hundred (that is, 84 pound) cost, being carried 40 miles?

First, place your numbers according to the tenor of the Question thus:

l.	*Miles*	*s.*	*l.*	*Miles*
112	120	14	84	40

```
 112          14
 120          12
 ----         --
 2240         28
 112          14
 ----         --
 13440        168 pence
               84
              ---
              672
             1344
             -----
             14112
                40
             ------
             564480
```

265,

26
1488
564480 (42
134400
1344

Your numbers being placed in order, reduce the 14 *s.* into pence, and it is 168 pence, then multiply 168 by 84, the product is 14112, which multiplied by 40, (the last number) it produceth 564480, for the Dividend.

Then multiply 112 by 120, it produceth 13440, for the Divisor.

Divide 564480 by 13440, the Quotient will be 42 pence, which is 3 *s.* 6 *d.* and answers the Question.

Thus in this Rule you may observe, that the first number and fourth, the second and fifth, and also the third and sixth are of like denominations.

Question 3.

If 100 *l.* for 6 moneths yield 3 *l.* interest, what shall 625 pound yield for 36 moneths?

Multiply the three last, as before is shewed, the later product is 67500, for the Dividend.

vidend. And the two first numbers multiplied make 600 the Divisor; then divide 67500 by 600, or 675 by 6, which is all one) the quotient will be 112 whole pounds, and 300 (or 3) remaining; which because it is half the Divisor, signifies the half of a pound, that is, 10 s. So the answer to the question is 112 l. 10 s.

l.	m.	l.	l.	m.
100	6	3	625	36
6			3	
600			1875	
			36	
2(3				
~~675~~ (112			11250	
~~666~~			5625	
			67500	

Which might have been given in one denomination, namely, 2250 shillings, if before the work the pounds had been turned into shillings, by multiplying them by 20, as hath been shewed before.

But since most questions, except such as are designed for the purpose, are apt to end in some Fractions, I shall next treat of Fractions.

Only

Only take notice, that all questions which are wrought at once by this compound Rule of five Numbers, may be done at twice by the single Rule of Three; and the doing of them so by two operations, is called the Double Rule of Three.

As in our last question there are two things considerable, the money, and the time.

First, for the money.

Say, if 100 *l.* give 3 *l.* what 625 *l.* answer, 18 $\frac{75}{100}$ *l.*

Secondly, for the time.

Say, if 6 *mo.* give 18 $\frac{75}{100}$ *l.* what 36 *mo.* answer, 112 $\frac{50}{100}$ *l.*

But this will be better understood, when Fractions are learned, which now we come to teach.

CHAP.

CHAP. X.

Of FRACTIONS.

A Fraction is the part of any entire thing, as when any thing is broken or divided into parts, those parts are called Fractions; as if a Pound in money be broken or divided into shillings, 17 *s.* is seventeen twenties of a pound, also 10 *s.* is ten twenties of a pound. Likewise if a shilling be the integer, then pence are the Fraction parts thereof; as 7 pence is seven twelfths of a shilling, 5 pence is five twelfths of a shilling, and so of any other number of pence. Also if a penny be the integer, then farthings are the Fraction parts thereof; as 3 farthings is three fourths of a penny, 2 farthings is two fourths of a penny, and one farthing is the one fourth of a peny.

And the like is to be understood of any other thing that may be parted, as of Weight, into Pounds, Ounces and Drams; or of Measure into Bushels, Pecks, Gallons, Quarts, *&c.* Or any other thing that may be broken into parts.

In Fractions we will begin first with *Numeration*, then with *Multiplication* and *Division*, then with *Reduction*, and lastly with *Addition* and *Substraction*. And the reason why I so do, will evidently appear by the work following; for *Multiplication* and *Division* are easier than *Addition* and *Substraction*, and may be performed without *Reduction*, which the other two cannot be.

Numeration of FRACTIONS.

NUmeration of Fractions teacheth how to write any Fraction down, and also how to express any Fraction that is already written; and that this may be done, we must consider, that any Unite or Number representing an Unite, may be broken into two parts equal, and then each of the parts is called *one half*; or it may be parted into three equal parts, and then each part is called *one third*; and two of them are called *two thirds*: and the like may be understood if the unite were parted into 4, 5, 6, 7, 8, 9, 20, 50, or 100, or how many soever parts.

Now to write these, do thus:

One

One half	$\frac{1}{2}$
one third	$\frac{1}{3}$
one fourth	$\frac{1}{4}$
one fifth	$\frac{1}{5}$
one sixth	$\frac{1}{6}$
one seventh	$\frac{1}{7}$
one eighth	$\frac{1}{8}$
one ninth	$\frac{1}{9}$
one tenth	$\frac{1}{10}$

In every one of these nine Fractions, the Number below the line is called the *Denominator*, and it shews into how many parts the unite is broken.

The Number above the line shews how many of those parts are taken, or contained in the Fraction, and is thence called the *Numerator*: So in the Fraction $\frac{3}{5}$ the Denominator 5 shews the unite to be broken into 5 parts, and the Numerator 3, signifies 3 of those parts to be contained in the Fraction, which Fraction therefore is called *three fifths*.

So that all Fractions are quotients of lesser numbers divided by greater, as $\frac{4}{7}$ signifies 4 to be divided by 7; and the line of separation which is drawn between the 4 and the 7, doth properly signifie Division.

Hitherto we have spoken only of such Fra-
ctions

ctions as are leſs than 1, which are called *Proper Fractions*: But there are alſo $2\frac{1}{2}$, $3\frac{3}{4}$, $5\frac{1}{7}$, $6\frac{3}{5}$, and the like, and theſe are called mixed Numbers, which ſo written ſignifie *two and an half, three and three quarters, five and a ſeventh, ſix and three fifths.* Theſe by multiplying Numbers by the Denominator, and to the product adding the Numerators reſpectively, are turned to $\frac{5}{2}$, $\frac{15}{4}$, $\frac{36}{7}$, $\frac{33}{5}$, which are called *Improper Fractions*, becauſe every one of them contains more than unitie.

Theſe neverthleſs may be multiplied, divided, added or ſubſtracted in the ſame way as proper Fractions are.

Multiplication of FRACTIONS.

ALl proper Fractions (which are all Fractions leſs than One) are ſtill made leſs by multiplying; and for Multiplibation this is,

THE RULE.

Multiply all the Numerators together; the laſt product ſhall be the Numerator of the product required; Likewiſe multiply all the Denominators together, the laſt product ſhall be the

the Denominator of the product sought.

Example 1.

If $\frac{3}{5}$ be to be multiplied by $\frac{4}{9}$ multiply the Numerator 3 by the Numerator 4, the product is 12, for the numerator of the new product. Also multiplying the Denominator 5, by the Denominator 9, they produce 45, for the Denominator of the desired product, so that the product which was required is $\frac{12}{45}$.

Example 2.

If $\frac{1}{2}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{9}$, and $\frac{3}{11}$, were to be multiplied altogether, begin with the Numerators, saying, once 3 is 3, and 3 times 4 is 12, and 12 times 5 is 60, and 60 times 3 is 180, for the Numerator: Then multiply the Denominators, saying, 2 times 4 is 8, and 8 times 5 is 40, and 40 times 9 is 360, and 360 times 11 is 3960 for the new Denominator, So that the product of all these is $\frac{180}{3960}$.

Example 3.

To multiply the mixt Numbers, $3\frac{1}{2}$, $4\frac{1}{3}$, $5\frac{3}{4}$: First (as hath been shewn already) turn them into improper Fractions, thus, first say,

2 times 3 is 6 and 1 is 7. So the first is $\frac{7}{2}$. Secondly, 3 times 4 is 12 and 1 is 13. So the second is $\frac{13}{3}$. Lastly, 4 times 5 is 20, and 3 is 23. So the last is $\frac{23}{4}$. Now the Fractions to be multiplied are $\frac{7}{2}$, $\frac{13}{3}$, and $\frac{23}{4}$. First, for a new Numerator, say, 7 times 13 is 91; and 91 times 23 is 2093, for a new Numerator.

Then say, 2 times 3 is 6, and 6 times 4 is 24. So the new Denominator is 24.

And the product of all these Fractions is $\frac{2093}{24}$, that is, if real Division be made, $87\frac{5}{24}$.

Division of FRACTIONS.

Division of one Fraction by another, is but the cross multiplying of them, for which this is

THE RULE.

Multiply the Numerator of the one, by the Denominator of the other, and hereby the proportion of one Fraction to another is seen.

Example 1.

$$\frac{3}{4}\;\overset{24}{\underset{24}{\mathbf{X}}}\;\frac{6}{8}$$

Divide $\frac{3}{4}$ by $\frac{6}{8}$, to do it set them thus: and multiply as the Cross leads, saying, 3 times 8 is 24, for a new Numerator, and 6 times 4 is also 24 for a new Denominator. So the quotient is $\frac{24}{24}$, that is 1, which shews the Fractions to be equal one to another.

Example 2.

$$\frac{3}{5}\;\overset{27}{\underset{20}{\mathbf{X}}}\;\frac{4}{9}$$

Divide $\frac{3}{5}$ by $\frac{4}{9}$. First, set them thus, and say, 3 times 9 is 27, for a Numerator: And 5 times 4 is 20, for the Denominator. So the quotient is $\frac{27}{20}$, and so many times is $\frac{4}{9}$ contained in $\frac{3}{5}$.

In Division it is to be remembred, that the *Numerator* of the quotient ever ariseth of the Numerator of the *Dividend*; and the *Denominator* of the quotient comes of the denominator of the *Dividend*, each being cross multiplied, as before.

If a Fraction be to be divided by a whole Number,

Number, multiply the denominator by that Number, the product gives the new denominator, and the Numerator remains the same. So if $\frac{1}{4}$ be divided by *9*, say *9* times 4 is 36. So the quotient is $\frac{1}{36}$.

Or if $\frac{1}{4}$ were to be multiplied by 9, the product (by multiplying the Numerator by 9) will be $\frac{9}{4}$, that is, $2\frac{1}{4}$.

Example 3.

$$\begin{array}{ccc} & 2880 & \\ \frac{320}{8} & \mathbf{X} & \frac{45}{9} \\ & 360 & \end{array}$$

Divide $\frac{320}{8}$ by $\frac{45}{9}$, thus, say 320 times *9* is 2880 for a Numerator; and 8 times 45 is 360 for a denominator. So the Quotient is $\frac{2880}{360}$.

Reduction of FRACTIONS.

OF Reduction of Fractions there are three varieties.

1 To reduce a Fraction to a lesser denomination.

2 To reduce many Fractions of divers denominations, to one denomination.

3 To reduce any Fraction from one denomination (as near as may be) to any other denomination desired.

For

For the first of these, this is

THE RULE.

Divide both the Numerator and the Denominator by the greatest common Divisor that you can think of, the two quotients being placed respectively in a Fraction, that Fraction shall be equal to the former Fraction, and in lesser terms.

So (in the third Example of Division to reduce $\frac{2880}{360}$ to $\frac{8}{1}$, divide 2880 by 360, the quotient is 8; then divide 360 by 360, the quotient is 1, and the new Fraction $\frac{8}{1}$ is equal to the former Fraction, $\frac{2880}{360}$, and in less terms as you may see. But to find the greatest common Divisor, this is

THE RULE.

Divide the greater term by the lesser, (I mean by terms, the Numerator and Denominator) *and by the remainder* (*if any be*) *divide the Divisor, and if any thing still remains, by that divide the last divisor, continuing this course till nothing remain greater than unity, that Divisor which is last of all, is the greatest common measure of both terms*

by which, both Numerator and Denominator being divided, and the quotients placed like a Fraction, that Fraction shall be equal to the former Fraction, and in the least terms.

Example.

Reduce $\frac{148}{16}$ to the least terms; first divide 148 by 16, the quotient is 9, and 4 remains: again divide 16 by 4, the quotient is 4, and nothing remains; wherefore taking 4, (the last divisor) for the greatest common divisor, by it divide 148, the quotient is 37, and by it divide 16, the quotient is 4. These two last quotients placed orderly in a Fraction, make $\frac{37}{4}$, which is equal to $\frac{148}{16}$, and in the least terms; for no number greater than 1, will divide evenly both 37 and 4.

Now secondly, to reduce many Denominations to one common Denominator; let the Fractions be $\frac{1}{2}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{7}{8}$, $\frac{9}{10}$, to be reduced all to the Denomination 3200.

The RULE.

Multiply all the Denominators together, saying 2 *times* 4 *is* 8, *and* 8 *times* 5 *is* 40, *and* 40 *times* 8 *is* 320, *and* 320 *times* 10 *is* 3200; *this last product* 3200, *shall be the common Denomi-*

Denominators. Then to get Numerators for every one of them: *Multiply every particular Numerator into all the Denominators except his own.* As first, for the first, say, once 4 is 4, and 4 times 5 is 20, and 20 times 8 is 160, and 160 times 10 is 1600.

For the first Numerator: So the first Fraction reduced is $\frac{1600}{3200}$. Then for the second Numerator, say, 3 times 2 is 6, and 6 times 5 is 30, and 30 times 8 is 240, and 240 times 10 is 2400. So the second Fraction reduced, is $\frac{2400}{3200}$. After the same manner may the other three be reduced to $\frac{2560}{3200}$ for the third, $\frac{2800}{3200}$ for the fourth, and $\frac{2880}{3200}$ for the last. These are severally equal to the other, the first to the first, &c. as may be proved thus,

Let the unite be a pound *Sterl.* then

	s.
The $\frac{1}{2}$ of it is	10
and $\frac{3}{4}$ is	15
and $\frac{4}{5}$ is	16
and $\frac{7}{8}$ is	17 *6 d.*
and $\frac{9}{10}$ is	18
In all	76 *s. 6 d.*

That is, 3 whole unites, and 16 *s.* and 6 *d.* over. Turn 16 *s.* 6 *d.* all to six pences, it is

33, and because 6 *d.* is the fortieth part of a pound, therefore all the Fractions are equal to to $3\frac{33}{40}$.

Now add the new Fractions which (being all of one denomination) may be added like whole Numbers, thus:

	1600
	2400
	2560
	2800
	2880
In all	12240

Which divided by the Denominator 3200 the quotient is $3\frac{1640}{3200}$. Now $\frac{2640}{3200}$, reduced to the least terms, as hath been shewed how it may, will be $\frac{33}{40}$, so the sum of these also is $3\frac{33}{40}$, which is equal to the sum of the Fractions given to be reduced, and therefore they are equal in sum, and might be thus proved equal severally, that is, the first of them propounded, to the first reduced. Divide the Numerator 1600 by the Numerator 1, the quotient is 1600. Also divide the Denominator 3200, by the Denominator 2, the quotient is also 1600, and so may any of the rest be proved equal by the equality of quotients.

Thirdly, Any Fraction being given, to change the Denomination to any other more requisite,

requisite, retaining still (as near as may be) the same value.

THE RULE.

Multiply the Numerator given, by the Denominator required, and divide the product by the Denominator given, the quotient shall be the Numerator required.

Example.

Let the Fraction given be $\frac{7}{13}$ of a pound *Sterling*, what is that in twenty parts, or shillings? Multiply 7 by 20, the product is 140; which divided by 13, the quotient $10\frac{10}{13}$, that is, 10 *s.* and $\frac{10}{13}$ of a shilling; which may be brought to pence thus, multiply 10 by 12, the product is 120, which divide by 13, the quotient $9\frac{3}{13}$ *d.* And again, multiply 3 by 4, the product is 12, which divided by 13, quotient is $\frac{12}{13}$ of a farthing, so seven thirteenths of a pound is 10 *s.* 9 *d.* and almost a farthing.

Fractions of Fractions.

In the Reduction of Fractions, some make another, or more parts, as Fractions of Fra-

ctions for one; that is, when there is a part of a Fraction, or part of a part of a Fraction, &c. to be valued in one Fraction.

THE RULE.

Multiply all the Nmerators together, the last product shall be the Numerator desired; then multiply all the Denominators together, and this last product shall be the Denominator sought.

Example.

Let the Fractions of Fractions propounded, be $\frac{4}{5}$ of $\frac{3}{4}$ of $\frac{1}{2}$, for so they are usually written; and let the Numerators be multiplyed, saying, 4 times 3 is 12, and 12 times 1 is 12, the Numerator therefore required is 12; then for the Denominator, say, 5 times 4 is 20, and 20 times 2 is 40, for the Denominator required; and $\frac{12}{40}$ is equal to $\frac{4}{5}$ of $\frac{3}{4}$ of $\frac{1}{2}$.

Proof.

Let the Unite be 40 *s.* one fifth of 40 is 8, and therefore $\frac{4}{5}$ is 32, of which one fourth is 8, and $\frac{3}{4}$ is 24, of which one half is 12, and therefore

fore $\frac{12}{48}$ is the just sum of all the Fractions. This needs no further exemplifying.

Addition of FRACTIONS.

IN the Adding of many Fractions into one sum, you are to consider whether they be of one Denomination or divers; if of one, then this is

THE RULE.

Add all the Numerators together into one sum, that sum is the new Numerator: and the Denominator is the same. As for

Example.

Let the Fractions to be added be $\frac{2}{4}$, $\frac{4}{4}$, $\frac{5}{4}$, $\frac{1}{4}$, add the Numerators, saying, 2 and 4 is 6, and 6 and 5 is 11, and 11 and 1 is 12. So the sum of them all is $\frac{12}{4}$, that is 3 unites.

As, let the Unite be 20 *s.* one fourth is 5 *s.* and $\frac{2}{4}$ is 10 *s.* and $\frac{4}{4}$ is 20 *s.* which added to 10 *s.* is 30 *s.* then $\frac{5}{4}$ is 25 *s.* which added to thirty shillings gives 55 *s.* And lastly, $\frac{1}{4}$ is 5 *s.* which added to 55 *s.* makes 60 *s.* that is 3 times 20 *s.* that is 3 *l.* or 3 Unites.

But if the Fractions to be added, be of divers denominations, as let them be $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{7}{8}$, then (by the reduction afore going, they must be turned all into one denomination, and then they will be $\frac{320}{480}$, $\frac{360}{480}$, $\frac{384}{480}$, and $\frac{420}{480}$, and may be added like those before, thus:

	320
	360
	384
	420
In all,	1484

So the sum of all is $\frac{1484}{480}$, or $\frac{371}{120}$, that is $3\frac{11}{120}$, which if it be money, and the Unite 1 *l.* it is then 3 *l.* 1 *s.* and 10 *d.* as may be tryed thus. First, $\frac{2}{3}$ of a pound, is 13 *s.* and 4 *d.* and $\frac{3}{4}$ is 15 *s.* and $\frac{4}{5}$ is 16 *s.* Lastly, $\frac{7}{8}$ is 17 *s.* 6 *d.* These all added together, the sum is 3 *l.* 1 *s.* 10 *d.*

	l.	*s.*	*d.*
$\frac{2}{3}$ of a pound is	0	13	4
$\frac{3}{4}$ of a pound is	0	15	0
$\frac{4}{5}$ of a pound is	0	16	0
$\frac{7}{8}$ of a pound is	0	17	6
In all	3	1	10

Substractions of FRACTIONS.

IN Substracting of one Fraction from another, if they be both of one denomination, this is

THE RULE.

Take the Numerator of one from the Numerator of the other, the remain is the new Numerator, and the Denominator the same as before.

So if $\frac{2}{9}$ be substracted from $\frac{8}{9}$, the remain is $\frac{6}{9}$, the like of all others.

But if they be not of one Denomination, they must first be reduced to be so, and then the substraction is the same as before.

The Golden Rule in Fractions is the same as in whole Numbers, I will give you but one instance here by the way, and Exemplifie it in the Rule it self, both direct and reverse, in the two next Chapters.

If $\frac{3}{4}$ of a yard of Tape, cost $\frac{1}{2}$ of a peny, what shall one inch, that is $\frac{1}{36}$ of a yard cost?

Multiply the second by the third, the product is $\frac{1}{72}$, which divided by $\frac{3}{4}$, the quotient

is $\frac{4}{216}$ of a peny, for the price of $\frac{1}{8}$ of a yard.

Otherwise.

Seeing $\frac{3}{4}$ of a yard may be turned into 27 inches; Say, if 27 cost $\frac{1}{2}$, what 1? divide $\frac{1}{2}$ by 27, it makes $\frac{1}{54}$ for the answer, which is equal to $\frac{4}{216}$, and in the least terms.

And wheresoever this may be done, to have the first and third Numbers fractions of one denomination, the best way is to work with their Numerators, not regarding their Denominators at all: as if $\frac{2}{3}$ cost $\frac{3}{4}$, what $\frac{7}{3}$? instead thereof write, if 2 cost $\frac{3}{4}$, what 7? multiply $\frac{3}{4}$ by 7, it produceth $\frac{21}{4}$, which divided by 2, the quotient is $\frac{21}{8}$, and that is the answer in the least terms.

And all this while it should have been noted, that Fractions are ever written in a smaller Figure than the whole Numbers.

How to Double, Triple, Quadruple any Fraction.

1. To Double	any Fraction, it is but to divide the same Fraction by	$\frac{1}{2}$
2. To Triple		$\frac{1}{3}$
3. To Quadruple		$\frac{1}{4}$
4. To Quindruple, &c.		$\frac{1}{5}$

The Proofs of Reduction, Multiplication, Division, Addition, and Substraction of Fractions.

ALthough this be, in some measure, hinted at in the respective Rules, yet not so obvious as the Learner thereby can discover it to be other then a particular proof of the Examples there delivered. But to come to a General Proof of each Rule, we will begin with

The Proof of Reduction.

ANy reduced Fraction being in the least Terms, if you multiply the Numerator and Denominator thereof by the Greatest common Measure, you shall bring it to its former part or parts.

Thus in our first Example $\frac{148}{16}$ was reduced to its least Terms, and by that means came to $\frac{37}{4}$. Now if you multiply 37 the Numerator of this Fraction by 4, the common measure by which it was reduced, it will produce 148, which was the Numerator of the Fraction before abbreviation was made, and 4 multiplyed by 4 produceth 16 for the Denominator thereof before abbreviation.

The

The Proof of Multiplication.

DIvide the Product of your whole Multiplication by the Multiplier, and in your Quotient you shall have the number by which you multiplied. And if you divide by the Multiplicand, you shall have in the Quotient the Multiplicator.

Thus, $\frac{2}{3}$ multiplied by $\frac{4}{5}$ will produce $\frac{8}{15}$. Now if you divide $\frac{8}{15}$ by $\frac{4}{5}$, it will produce $\frac{40}{60}$ or $\frac{2}{3}$. And if you divide $\frac{8}{15}$ by $\frac{2}{3}$, you shall have $\frac{24}{30}$ or $\frac{4}{5}$.

The Proof of Division.

MUltiply the Quotient produced by any Division, by the Divisor, and you shall have the number by which you did divide.

So $\frac{2}{3}$ being divided by $\frac{3}{4}$ will produce $\frac{8}{9}$ for Quotient; which $\frac{8}{9}$ being multiplied by the Divisor $\frac{3}{4}$, it will produce $\frac{24}{36}$, which in the least Terms is $\frac{2}{3}$, which was the former Dividend.

The Proof of Addition.

SUbstract one Number or Numbers which you added from the other Number or Numbers, and the remainer or remainers

shall

shall be equall to the other Number or Numbers.

Thus $\frac{1}{3}$ and $\frac{1}{4}$ being added together, will produce $\frac{7}{12}$. Now if from $\frac{7}{12}$ you substract $\frac{1}{3}$, there will remain $\frac{1}{4}$; or if from the other number $\frac{7}{12}$ you substract $\frac{1}{4}$, the remainer will be $\frac{1}{3}$.

The Proof of Substraction.

Adde the Number which you did substract, and the number which did remain together, and the sum shall be equal to the sum out of which you substracted the remainer. Or if you adde the two lesser numbers, you shall find the greater number.

If you substract $\frac{1}{4}$ from $\frac{2}{3}$, there will remain $\frac{5}{12}$. Now if you adde $\frac{5}{12}$ and $\frac{1}{4}$ together, and they make $\frac{16}{48}$ or $\frac{1}{3}$, which is the greater of the Numbers. And let this suffice for the Proof of Fractions.

CHAP. XI.

The Golden Rule, *or* Rule of Three *Direct in Fractions.*

THe manner of working the Golden Rule in Fractions differs little from that in whole Numbers. As by the Examples in the former Chapter may appear: The manner of working of it is in general thus, and this is

THE RULE.

Multiply the Numerator of the first Fraction by the Denominator of the second, and that by the Denominator of the third, for your divisor.

Again, *Multiply the Denominator of the first number, by the Numerator of the second, and that by the Numerator of the third, for your dividend.*

An Example or two will make it plain.

Question 1.

If $\frac{3}{4}$ of an Ell of Linnen Cloth cost $\frac{1}{2}$ of a Crown, what shall $\frac{1}{36}$ of an Ell cost?

Place the numbers as these following.

Ells

Ells	Cr.	Ells
$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{36}$

By your Rule, Multiply 3, the Numerator of the first Fraction, by 2 the Denominator of the second Fraction, and it maketh 6, that multiply by 36, the Denominator of the third Fraction, produceth 216, which is your divisor.

Again, Multiply 4 the Denominator of the first Fraction, by 1 the Numerator of the second, it is still 4, multiply by 1, the Numerator of the third, produceth still 4, for your Dividend; which being less than the Divisor, must be set thus $\frac{4}{216}$, of a Crown; for the price of $\frac{1}{36}$ of an Ell, which in the least terms is $\frac{1}{54}$. See the work.

Ells	Cr.	Ells
$\frac{3}{4}$	$\frac{1}{2}$	$\frac{1}{36}$
$\frac{1}{4}$	$\frac{3}{6}$	$\frac{6}{216}$
$\frac{1}{4}$		
	$\frac{4}{216}$	

Question 2.

If $\frac{7}{9}$ of an ounce of Silver, cost $\frac{4}{20}$ of a pound Sterling, what shall $\frac{3}{83}$ of an ounce cost?

Answ.

Answ. $\frac{208}{1820}$, or in lesser terms $\frac{27}{4550}$. See the work.

ou.	*l.*	*ou.*
$\frac{7}{9}$	$\frac{4}{20}$	$\frac{3}{13}$
4	7	
36	140	
3	13	
108	420	
	140	
	1820	

Other Examples.

1. If $\frac{3}{4}$ of a yard of Velvet, cost $\frac{2}{3}$ of a pound Sterling, what shall $\frac{5}{8}$ of a yard cost?

ya.	*ou.*	*ya.*
$\frac{3}{4}$	$\frac{2}{3}$	$\frac{5}{8}$
2	3	
8	9	
5	6	*Answ.* $\frac{40}{54}$ or $\frac{7}{12}$
40	54	

2. If

2. If $\frac{11}{12}$ of an ounce of Silver be worth $\frac{12}{4}$ of a Crown, what is $\frac{1}{2}$ worth?

ou.	*cr.*	*ou.*
$\frac{11}{12}$	$\frac{12}{4}$	$\frac{1}{2}$
12	11	
24	44	
12	2	
144	88	
1		
144		

(5
6(6
~~144~~(1
88

Ans. 1 $\frac{56}{88}$ or 1 $\frac{7}{11}$.

3. If $\frac{2}{3}$ of Gallon of Wine be worth $\frac{4}{5}$ of 20 sh. what is $\frac{7}{8}$ of a Gallon worth?

$\frac{2}{3}$ $\frac{5}{4}$ $\frac{7}{8}$

$\frac{4}{12}$ $\frac{2}{10}$

$\frac{7}{84}$ $\frac{8}{80}$ *Answ.* $\frac{84}{80}$ or 1 $\frac{4}{80}$.

$\frac{84}{80}$. That is, 1 *l.* 1 *s.*

CHAP.

CHAP. XII.

The RULE *of* THREE *Reverse in FRACTIONS.*

IN this Rule you must go contrary to the former, as in whole numbers: For this is

THE RULE.

Multiply the Numerator of the first Fraction, by the Numerator of the second Fraction, and the Product by the Denominator of the third, for your Dividend. *Then the Denominator of the first, by the Denominator of the second, and that by the Numerator of the third, for your* Divisor.

Question 1.

If when the price of a Quarter of Wheat is 2 *s.* the farthing white loaf shall weigh 68 *s.* I demand then what such a loaf shall weigh when the Quarter of wheat is worth 3 *s.*

s.

s.	s.	s.
$\frac{2}{20}$	$\frac{68}{20}$	$\frac{3}{20}$
68	20	
2	20	
136	400	
20	3	
2720	1200	

Answer, (3 l. s. d.

~~27~~(20 ($2\frac{32}{120}$, or 2 5 4

~~1200~~

Question 2.

When the price of a Quarter of Wheat is 9 *s.* what shall the farthing white loaf weigh?

s.	s.	s.
$\frac{2}{20}$	$\frac{68}{20}$	$\frac{9}{20}$
68	20	
2	20	
136	400	
20	9	
2720	3600	

		l.	s.	d.
Answer,	$\frac{272}{360}$ or	00	15	$1\frac{1}{2}$

Note

Note, That by a shilling you must understand $\frac{1}{20}$ of a pound weight, and so by a peny $\frac{1}{240}$ of an ounce of the Assize of bread, as by the Examples doth appear.

Note also in this Rule, if all your 3 numbers be of one Denomination, you shall work only with the Numerators, as in the second Example, and in this which followeth:

How much Calico of $\frac{1}{2}$ a yard broad will serve to line 32 $\frac{1}{2}$ yards of Satten which is 1 $\frac{1}{2}$ yards broad?

$1\frac{1}{2}$ $\frac{65}{2}$ $\frac{3}{2}$

Here, the *Less* Breadth, the *More* Yards, wherefore Multiply the Numerator 65 by the Numerator 3, which makes 195, and divide by the Numerator 2, the Quotient will be 97 $\frac{1}{2}$, and so many yards of Calico will line the 32 $\frac{1}{2}$ Yards of Satten.

CHAP.

CHAP. XIII.

The RULE *of* FELLOWSHIP, *without Time.*

OF this Rule of Fellowſhip, there are two kinds, the one with Time, the other without Time, It is a right neceſſary Rule for Merchants, Partners in Ships, Adventurers at Sea, and all ſuch as Trade in Company with a joynt Stock, and are to ſhare a proportional part either of Gain or Loſs.

We will begin with Fellowſhip without Time, to work which this is

THE RULE.

Add the ſeveral Sums, that the ſeveral perſons Adventuring put into Stock all together, which ſum ſhall be the firſt number in the Rule of Three Direct. Then, *the ſum that is either* gained *or* loſt *in the Adventure, ſhall be the ſecond number in the Rule of Three :* And *The third number in the Rule ſhall be the* ſum of *money that every perſon put into Stock ſeverally.*

Queſtion

Question 1.

Simon, *George* and *Peter*, make a Stock of money to the value of 3762 *l.* which they imploy in Trade, till at length they make it worth 5430 *l.* *Simon* put in 563 *l.* *George* put in 765 *l.* and *Peter* put in 2434 *l.* how much must either of the parties have of the Gain, in full recompence of his money put in.

Add the several sums that the three parties put in together thus,

	l.
Simon put in	563
George put in	765
Peter put in	2434
The whole Stock	3762

First, for Simons *share, say,*

If 3762 *l.* the whole Stock, Gain 5430, what shall 563 *l.* Gain? which is *Simons* share put in.

Place your numbers as in the Example, and working by the Rule of Three, you shall find 812 *l.* $\frac{2346}{3762}$ parts of a pound, which is *Simons* share.

See

See the work.

First, For *Simons* share.

```
     l.          l.
If 3762  gain  5430  what 563?
                563
               ----
              16290
             32580
            27150
            -----
            3057090

            (2
             3
             9(3
            1044(4
            4785
           69947(6
          3057090 (812 2346/3762
          37622
           3766
            37
```

Secondly,

Secondly, For Georges *share.*

l. *l.* *l.*

If 3762, Gain 5430, what 765

765

27150
32580
38010

4153950

13 (7
3259 (0
149172 (2
4153950 (1104 $\frac{702}{3762}$
3762222
37666
377
3

Thirdly, For Peters *share.*

l. *l.* *l.*

If 3762, Gain 5430, what 2434

5430

73020
9736
12170

13216620

```
        1
       43
     14512(7
    298992(1
    413000  (4
  1322166210  (3513 714/3762
    3762222
     37666
      377
       3
```

For *Peters* share $3513\frac{714}{3762}$

So that,

Simon gained	$812\frac{2346}{3762}$
George gained	$1104\frac{902}{3762}$
Peter gained	$3513\frac{714}{3762}$
In all	$5429\frac{3762}{3762}$

equal to the whole gain.

The Fractions being reduced into Coyn.

	l.	s.	d.	q.
Simons share will be	822	12	5	$2\frac{2964}{3762}$
Georges share will be	1104	3	8	$3\frac{522}{3762}$
Peters share will be	3513	3	9	$2\frac{276}{3762}$
The whole gain	5430	0	0	0

Which proves the work to be true.

Question 2.

A. B. and *C.* joyn their money to make a Stock of 25000 l. of which *A.* laid in 10000 l. *B.* 8000 l. and *C.* put in 7000 l. with this (after a certain time in Trading) they gained 7500 l. how must this be parted?

First for A.

Say, if 25000 gain 7500, what 10000?

Or shorter, if 25 get $7\frac{1}{2}$, what 10? Multiply $7\frac{1}{2}$ by 10, it produceth 75, which divided by 25, the quotient is 3, that is, (restoring the 3 Cyphers) 3000 l. for *A.*

Then for B.

Say, if 25000 gain 7500, what 8000?

Or shorter, if 250 get 75, what 80?

Multiply and divide as the *Golden Rule* requires, and to the quotient, restore the two Cyphers) then it will be 2400 *l.* for *B.*

Lastly, for C.

Say, if 250 give 75, what 70? answer 21, to which put the two Cyphers, it makes 2100 for C.

And

And these three, 3000, 2400, and 2100 being added together, make 7500. And have that proportion as the particular Stocks had; and therefore the work is right.

(I) *For* A.

If 25 gain $7\frac{1}{2}$, what 10?

150

$7\frac{1}{2}$ $\frac{15}{2}$ X $\frac{10}{1}$

2

~~1~~
~~1~~~~5~~~~0~~(75
~~2~~~~2~~

~~1~~
~~7~~~~5~~ (3 3000 *l.* for *A.*
~~2~~~~5~~

(II) *For* B.

If 25000 gain 75, what 80?

80

250) 6000 (24

500
1000

1000

2400

(III) For *C.*

If 250 gain 75, what 70?

```
              70
          --------
250) 5250 (21
     ----------
       500
        250
      ------
       250

      2100 for C.
```

And if instead of gaining 7500 *l.* whereby every one is supposed to have his Stock and a part of the gains; they had lost 7500 *l.* then of their particular Stocks had been due to them but so much as would be left after their proportional parts of the loss were abated.

Question 3.

A.B. and *C.* with a joynt Stock of 25000 *l.* gain 7500 *l.* of which *A.* gets 3000. *B.* 2400 *l.* *C.* 2100 *l.* what was their Stock?

This is but the Converse of the former; therefore say, if 5700 require 25000, what doth 3000 require? *Answer*, 10000 for *A.* and so work for the other two.

CHAP. XIV.

The RULE *of* FELLOWSHIP, *with* TIME.

IN this Rule of Fellowship with Time, there are two things chiefly to be considered, Namely, the difference of stock, and the difference of time. The best way to perform it is by multiplying the money and the time of each Adventurer together, and all those products added together to be the whole Stock. For,

As the Sum of these Products, is to the whole gain or loss;
So is each particular Product, to that particular mans gain or loss.

So then the Rule is wrought as that without time, as by Examples following will appear.

Question 1.

William, *Robert* and *Thomas*, make a Stock of 10000 *l.* *William* puts in 4000 *l.* for three moneths; *Robert* puts in 3000 *l.* for 6 moneths; and *Thomas* puts in 3000 *l.* for 8 moneths;

moneths; with this they gain 2000 *l.* what must each party have of the gain?

First, for *William*, multiply 4000 *l.* his Stock, by 3 his time, it makes 12000, which let be accounted his particular Stock.

Secondly, for *Robert*, multiply 3000 his Stock, by 6 his time, it makes 18000 for his Stock.

Lastly, for *Thomas*, multiply 3000 his Stock, by 8 his time, it produceth 24000, for his Stock; these three added together, make 54000 *l.* which is the general Stock; Then say,

For *William.*

If 54000 give 2000, what 12000? answer, $444\frac{24000}{54000}$.

Then for *Robert.*

If 54000 give 2000, what 18000? answer, $666\frac{36000}{54000}$.

Lastly, for *Thomas.*

If 54000 give 2000, what 24000? answer, $888\frac{47000}{54000}$.

The

The three Fractions being reduced to lesser terms will be $444\frac{4}{9}$, $666\frac{6}{9}$, and $888\frac{8}{9}$, which altogether, make 2000 l. as they ought, and as by the work following doth appear.

William 4000 *l.* for 3 moneths,
3
12000 *Williams* Stock.

Robert 3000 l. for 6 moneths,
6
18000 *Roberts* Stock.

Thomas 3000 l. for 8 moneths,
8
24000 *Thomas* Stock.

These added make	12000
	18000
	24000
The general Stock.	54000

Then for Williams *share, say,*

If 54000 gain 2000 *l.* what 12000?
2000
———
24000000

2(2
244(4
24000(000 (444 $\frac{24000}{54000}$
5444000
55 *Williams* share.

Then for Roberts *share.*

If 54000 gain 2000 *l.* what 18000?
2000
———
36000000

3(3
366(6
36000(000 (666 $\frac{36000}{54000}$
5444000
55 *Roberts* share.

Lastly, for Thomas *share.*
If 54000 gain 2000 *l.* what 24000?
2000
———
48000000
4(4

4 (4
488 (8
48000 (000 (888 $\frac{48000}{54000}$
5444000
55 *Thomas* share.

Which Fractions being Reduced, and the three shares added together, make 2000 *l.* which proves the work to be true.

$444\frac{4}{9}$
$666\frac{6}{9}$
$888\frac{8}{9}$

2000

Question 2.

Three Farmers, *A. B.* and *C.* lay out 1000 *l.* to Stock their ground with Cattle, of which *A.* put in 200 *l.* for 6 years, *B.* had 300 *l.* going for four years, and *C.* 500 *l.* for 2 years; at the end (by unseasonable times) there was lost 200 *l.* which made the remain of their Stock but 800 *l.* what was each mans Loss?

Multiply 200 by 6, it gives 1200. Likewise 300 by 4, it gives 1200. Lastly, 500 by 2, the product is 1000; all these are 3400 for the Joynt-Stock.

Then first for *A.*

Say, if 3400 lose 200, what 1200? an-

swer, $70\frac{2000}{3400}$ for *A.* to which *B.* is also equal, because their Stock and time together are equal.

Therefore, for C.

Say, if 3400 lose 200, what 1000? answer, $58\frac{2800}{3400}$. So the 3 shares are $70\frac{20}{34}$, $70\frac{20}{34}$ and $28\frac{28}{34}$, equal to 200.

Now because *A.* put in 200 *l.* and lost $70\frac{20}{34}$, substract his loss from his Stock, remains $129\frac{14}{34}$.

And so doing for *B*, his remain will be $289\frac{14}{34}$.

And for *C*, his remain is $441\frac{6}{34}$.

Now these three remains, $129\frac{14}{34}$, $289\frac{14}{34}$, and $441\frac{6}{34}$, make up 800 l. which was the whole remain.

Question 3.

A. Rents a Close for a year, to pay 80 l. he puts into it 200 sheep: 2 moneths after *B.* puts 40 sheep in; and 5 moneths after that C. puts in 100 sheep; how much must every one pay of the Rent?

Multiply

Multiply 200 by 12, it produceth	2400
And 40 by 10, produceth	400
Laftly, 100 by 5 produceth	500
In all	3300

Then for A.

If 3300 pay 80, what 2400? anfwer, $58\frac{600}{3300}$.

Then for B.

If 3300 pay 80, what 400? anfwer, $9\frac{2300}{3300}$.

And for C.

If 3300 pay 80, what 500? anfwer, $9\frac{400}{3300}$.

The whole numbers make 79, and the Fractions make 1, In all 80.

Queftion 4.

Two Merchants A. and B. company; A. puts in 450 *li.* the firft of *January*, B. puts in 750 *li.* the firft of *May*, at the years end they have gained 100 *lib.* what is eithers gain?

A. his money, *viz.* 450 *li.* continued in Stock the whole year, or 12 moneths, wherefore multiply 450 by 12, and it maketh 5400.

B.

B, his 750 *li.* was in but 8 moneths, wherefore multiply it by 8, and it produceth 6000. These two added together make 11400. This done, Say by the Golden Rule,

As 11400. the whole Stock and time
Is to 100 *li.* the whole Gain,
So is 5400 A, his Stock and time
To 47 $\frac{7}{19}$ *li.* for A, share.

Then for B. share.

As 11400 : to 100 *li.* :: So 6000 : to 52 $\frac{12}{19}$.

As in the work appears.

I. For A.

11400 —— 100 —— 5400
100

x(4
87
x04(2 540000
84000(00 (47 $\frac{42}{114}$ A. share.
x1440 0
xx

li.	*s.*	*d.*	*q.*
47	7	4	1 $\frac{13}{19}$

II. For

II. *For B. Share.*

11400——100——6000
1   100
3(7   ———
158(2   600000
600000 $(52\frac{12}{19}$ for B. share.
114400
11

	li.	*s.*	*d.*	*q.*
	52	12	7	$2\frac{6}{19}$

So that	*l.*	*s.*	*d.*	*q.*
A. had for his share	47	7	4	$1\frac{13}{19}$
B. had	52	12	7	$2\frac{6}{19}$
In all	100	0	0	0

Equal to the whole Gain.

A. and B. Company for a Year.

A. puts in 640 *l.* *January* 1. But B. cannot put in till *April* 1. What money must B. then put in, that at the years end he may have equal Profit with A?

Multiply A. money by 640 *l.* by its time 12 moneths, it makes 7680. and so much should B. put in. But seeing he cannot put in till 3. moneths after, his Stock will be in but 9 moneths, wherefore, divide 7680 by 9, and you shall have in the Quotient $853\frac{1}{3}$, and so much ought B. to put in the first of *April*, and to receive the half profit or loss at the Years end.

CHAP.

CHAP. XV.

The Rule of PRACTICE.

THe Rule of Practice is nothing else but a compendium of the *Direct Rule of Three.*

For the ready performance of this Rule, you are to know readily the even parts of one Peny, of one Shilling, of one Pound, &c. Which these Tables following will plainly shew, and they must be learned by heart, which will be easie to do when you are any way accustomed to use them.

The even parts of a Peny.

$$\left.\begin{matrix}1\\2\\3\end{matrix}\right\}\text{ farthing is the }\left\{\begin{matrix}\frac{1}{4}\\\frac{1}{2}\\\frac{3}{4}\end{matrix}\right\}\text{ of a Peny.}$$

The even parts of a Shilling, are Pence.

$$\left.\begin{matrix}6\\4\\3\\2\\1\end{matrix}\right\}\text{ is the }\left\{\begin{matrix}\frac{1}{2}\\\frac{1}{3}\\\frac{1}{4}\\\frac{1}{6}\\\frac{1}{12}\end{matrix}\right\}\text{ of a shilling.}$$

This

This Table is thus to be read and learned.
Six pence is the $\frac{1}{2}$ of a shilling,
Three pence is the $\frac{1}{4}$ of a shilling,
One peny is the $\frac{1}{12}$ of a shilling, and

The manner of using this and the following Tables, will appear by the following Questions.

At six pence the yard, what are 7632 yards worth?

Six pence being the one half of a shilling, you must therefore take the half of 7632, and it is 3816, which are so many shillings, that Divide by 20 (which is done by cutting off the last figure towards the right hand, and taking the half of the other figures) there is 190 l. 16 s. which is the price of 7632 pound of any Commodity at 6 pence the pound.

See the work.

At 6 *d.* the pound, what 7632 pound?

6 *d.* $\frac{1}{2}$	381|6		
	l.	*s.*	*d.*
	190	16	0

At 4 *d.* the yard, what 9763 yards?

Four pence being $\frac{1}{3}$ of a shilling, take $\frac{1}{3}$ of the number.

At

At 4 *d.* the yard, what 9763 yards?

		d.
4 *d.* $\frac{1}{3}$	325|4	4
l.	*s.*	*d.*
162	14	4

Here when you had taken the third part of 9763, it produced 3254 shillings, and one remaining, which one remaining, representing $\frac{1}{3}$ of a shilling, which is 4 *d.* and therefore set it down: Also when you took the half of 325, it produced 162, and one remaining, which one that remained representeth 10 *s.* which being joyned to that 4 that is cut off, maketh it 14 *s.* So the whole price comes to be 162 *l.* 14 *s.* 4 *d.*

I have been the larger in these two first Examples, because I intend only to set down the other that follow, and leave them to your own Practice.

At 3 *d.* the Gallon, what 3795 Gallons?

3 *d.* $\frac{1}{4}$	94|8	9 *d.*
l.	*s.*	*d.*
47	8	9

At

At 2 *d.* the pound, what 97625 pound?

d.			*d.*
2 $\frac{1}{6}$	1627|7		10
	l.	*s.*	*d.*
	81	7	10

At 1 *d.* the ounce, what 6725 ounces?

			d.
1 *d.* $\frac{1}{12}$	56|0		5
	l.	*s.*	*d.*
	28	0	5

Uneven parts of a Shilling.

The uneven parts of a shilling are 5 *d.* 7 *d.* 9 *d.* 10 *d.* and 11 *d.* Wherefore if any question be proposed, where any of these uneven numbers is the price, you must

			d. *d.*
For	5	pence take	3 and 2
	7		4 and 3
	9		6 and 3
	10		6 and 4
	11		4 and 4 and 3 *d.*

As by the Questions following will appear.

At

At 5 *d.* the yard, what 758 yards?

3 *d.* $\frac{1}{4}$	189	6 *d.*
2 *d.* $\frac{1}{6}$	126	4 *d.*
	31|5	10 *d.*

l.	*s.*	*d.*
15	15	10

At 7 *d.* the pound, what 563 pound?

4 *d.* $\frac{1}{3}$	187	8 *d.*
3 *d.* $\frac{1}{4}$	140	9 *d.*
	32|8	5 *d.*

l.	*s.*	*d.*
16	8	5

At 8 *d.* the Ell, what 112 Ells?

4 *d.* twice $\frac{1}{3}$	37	4 *d.*
	37	4 *d.*
	7|4	8

l.	*s.*	*d.*
3	14	8

At

At 9 *d.* the dozen, what 498 dozen?

$6\frac{1}{2}$	249		*d.*
$3\frac{1}{4}$	124		3
	37|3		3
	l.	*s.*	*d.*
	18	13	3

At 10 *d.* the Gross, what 9769 Gross?

$6\frac{1}{2}$	4884		6 *d.*
$4\frac{1}{3}$	3256		4
	814|0		10
	l.	*s.*	*d.*
	407	0	10

At 11 *d.* the quart, what 7895 quarts?

$4\frac{1}{3}$	2631		8 *d.*
$4\frac{1}{3}$	2631		8
$3\frac{1}{4}$	1973		9
	723|7		1
	l.	*s.*	*d.*
	361	17	1

The

The even parts of a Pound Sterling, or Twenty shillings.

The even parts of a pound or 20 *s.* are, 10 *s.* 5 *s.* 4 *s.* 2 *s.* 1 *s.* to which may be added 6 *s.* 8 *d.* and 3 *s.* 4 *d.* and 2 *s.* 6 *d.* some others, too many here to enumerate, or to trouble the Reader to retain in memory: but those sufficient for use this Table following declares.

10	is the	$\frac{1}{2}$	of a Pound.
6 8 *d.*		$\frac{1}{3}$	
5		$\frac{1}{4}$	
4		$\frac{1}{5}$	
3 4 *d.*		$\frac{1}{6}$	
2 6 *d.*		$\frac{1}{8}$	
2		$\frac{1}{10}$	
1		$\frac{1}{20}$	

At 10 *s.* the yard, what 372 yards?

10 $\frac{1}{2}$ 186

At 6 *s.* 8 *d.* the pound, what 479 pound?

s. *d.* 6 8 $\frac{1}{3}$ 159 13 *s.* 4 *d.*

At 5 *s.* the Piece, what 984 pieces?

$5 \frac{1}{4}$ 246 *l.*

At 4 *s.* the Ell, what 762 Ells?

$4 \frac{1}{5}$ 152 *l.* 8 *s.*

At 3 *s.* 4 *d.* the Yard, what 9621?

3 *s.* 4 *d.* $\frac{1}{6}$ 1603 *l.* 10 *s.*

At 2 *s.* 6 *d.* the Pound, what 9653 pound?

2 *s.* 6 *d.* $\frac{1}{8}$ 1206 *l.* 12 *s.* 6 *d.*

At 2 *s.* the Gallon, what 144 Gallons?

2 $\frac{1}{10}$ 14 *l.* 8 *s.* 0 *d.*

At 1 *s.* the Ell, what 6957|3 Ells?

1 *s.* $\frac{1}{20}$ 347 8 *l.* 14 *s.* 0 *d.*

Uneven parts of a pound Sterling, or twenty Shillings.

The uneven parts of twenty shillings are, 3, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19 *s.*

Wherefore, if any Question be put at any of

of these Rates, you must do as in the uneven parts of a shilling, take two such even parts as will make up your uneven part, As this Table shews.

	Shil.		*Sh.*	*Sh.*
For	3	Shillings take	2 and	1
	6		4	2
	7		5	2
	8		4	4
	9		5	4
	11		10	1
	12		10	2
	13		10	2 and 1
	14		10	4
	15		10	5
	16		10	5 and 1
	17		10	5 and 2
	18		10	5 and 3
	19		10	5 and 4

As by some Questions following.

At 16 *s.* the Piece, what 7569 Pieces?

10 *s.* $\frac{1}{2}$	3784	10
5 $\frac{1}{4}$	1892	5
1 $\frac{1}{20}$	378	9
	6055	4

At

At 19 *s.* the yard, what 2659 yards?

10 $\frac{1}{2}$	1329	10 *s.*
5 $\frac{1}{4}$	664	15
4 $\frac{1}{5}$	531	16
	2516	01

At 13 *s.* 7 *d.* 3 *q.* the Galon, what 79 $\frac{1}{2}$ Gallons?

	l.	*s.*	*d.*	*q.*
5 *s.* $\frac{1}{4}$	19	15	0	0
4 *s.* $\frac{1}{5}$	15	16	0	0
4 *s.* $\frac{1}{5}$	15	16	0	0
4 *d.* $\frac{1}{3}$	1	6	4	0
3 *d.* $\frac{1}{4}$	0	19	9	0
2 *q.* $\frac{1}{24}$		3	3	2
1 $\frac{1}{48}$		1	7	3
The $\frac{1}{2}$ Gallon		6	9	3 $\frac{1}{2}$
In all	54	4	10	0 $\frac{1}{2}$

Many other Questions might be added, but let these suffice.

CHAP.

CHAP. XVI.

The RULE *of* BARTER, *or* EXCHANGE.

THis Rule is of good use for Merchants and others, that have Factors in other Countries, who send their Masters over Commodities not proper for their Trade at home; so that the Merchant is forced to exchange or Barter them away for such Commodities as are in his way, or he hath occasion for: It is no other than the Rule of Three, and few Questions will make it plain.

Question 1.

A Merchant hath 24 Broad-cloths, which he values at 10 l. 10 s. the piece, which he is willing to Barter for a parcel of *Mace*, at 12 s. the pound, how much *Mace* must he have for his 24 Cloths.

Say by the Rule of Three,

If 1 Broad-Cloth be worth 10 *l.* 10 *s.* what are 24 worth?

Answer, 252 *l.*

Then say again by the Rule of Three.

If

If 12 *s.* buy one pound of *Mace*, what shall 252 *l.* or 5040 *s.* buy?

Answer, 420 *l.* of *Mace*; and so much *Mace* must he have for his 24 Broad-Cloths. See the Work.

Broad-Cloth.				Mace.		
b·c.	l.	s.	b-c.	s.	p.	l.
1	10	10	24	12	1	5040
	20					
	210					
	24					
	840				~~22~~	
	420				~~5040~~ (420 *l.*	
	5040				~~1222~~	
l.		s.	d.		~~11~~	
252		00	00			

Many words are needless, seeing the Rule it self is plain, only for Example, take these Questions following, with their Solutions and operations.

1. Two Barter, the one hath 420 pound of *Mace*, at 12 *s.* the pound, the other hath *Broad-Cloth* at 10 *l.* 10 *s.* the Piece, how many *Broad-Cloths* ought he to give for all his *Mace*? *Answer*, 24.

Mace.			Broad-Cloth.			
p.	s.	p.	l.	s.	b-c.	s.
1	12	420				
		12	10	10	1	5040
			20			1
		840				
		420	210			5040
			18			
		504|0	5040 (24 Broad-c.			
			2200			
		252 *l.*	22			

2. Two Barter; the one hath 32 Pieces of *Canvas*, at 16 *l.* 7 *s.* the Piece, the other hath *Baise* at 2 *s.* 3 *d.* the Ell, how many Ells of *Baise* for all his *Canvas*? *Answer*, 4650 Ells.

Canvas

Canvas.

can.	l.	s.	can.
1	16	07	32

20

327
32

654
981

1046|4

523 l. 4 s. 0 d.

Baise.

s.	d.	Ell.	l.	s.
2	3	1	523	4

12 20

27 10464
12

20928
10464

125568

x
x53
473 (1
x2556(8 (4650 $\frac{2}{3}$
x7777
x22

3. Two Barter, the one hath 4650 $\frac{2}{3}$ Ells of Baise, at 2 *s.* 3 *d.* the Ell, the other hath Canvas at 16 *l.* 7 *s.* the piece; how many pieces of Canvas for 4650 $\frac{2}{3}$ Ells of Baise?

Answer, 32 Pieces.

Baise.				Canvas.				
Ell.	*s.*	*d.*	*ell.*	*l.*	*s.*	*pi.*	*l.*	*s.*
1	2	3	$4650\frac{2}{3}$	16	7	1	523	4
3	12		3	20			20	
3	27		13952	07			10464	
			27	32				
			97664	327				
			27904					
			376704					

61
185
10464) 32 pieces.
3277
32

1111
376704 (125580
333338

1
274
125568 (1046|4
1222222
1 1111 *l.* *s.* *d.*
523 4 0

4. Two Barter, the one hath Indigo at 4 *s.* *per* pound, ready money, but in Barter he will have 4 *s.* 9 *d.* the other hath Kersie at 3 *s.* 6 *d.* the yard ready money, at what Price must he Rate

Rate his Kersie in Barter, that he may be no loser?

Say by the Rule of Three,

If 4 *s.* in Barter, give 9 *d.* what shall 3 *s.* 6 *d.* give?

```
 s.   d.    s.   d.
 4    9     3    6
12         12
---        ---
48         42
            9
           ---
           378

 (4
 9(2
 378 (7 42/48 or 7/8 viz. 3 1/2
 48
```

	s.	d.	q.
	3	6	0
	0	7	3 ½
The price of the Kersies by the yard must be	4	1	3 ½

5. Two Barter, One hath 120 yards of Broad-Cloth, for which in ready money he will have 15 *s. per* yard, but in Barter he will have 18 *s. per* yard. The other hath Hops at 4 *l.* 5 *s.* the C. ready money, how must he

rate his Hops, and how many C. of Hops must he give for all his Broad-Cloath ?

First, 120 yards of Broad-Cloath at 18 *s.* (which is the price he will have *per* yard in Barter) comes to 108 *l.*

Secondly, if 15 *s.* ready money, gain 3 *s.* in Barter, what shall 4 *l.* 5 *s.* gain ?

The Answer will be 17 *s.* wherefore he must Rate his Hops in Barter at 5 *l.* 2 *s.* *per* C.

Thirdly, say, If 5 *l.* 2 *s.* buy 1 C. of Hops, how many C. shall I buy for 108 *l.* ? Multiply and Divide, and you shall find 21 *C.* 0 *qr.* 19 $\frac{39}{52}$ *l.* And so many Hops must he give for his 120 yards of Cloath.

l.	s.	C.	l.	(1
5	2	1	108	~~1~~~~2~~(8 C.
20			20	~~2~~~~1~~~~6~~~~0~~(21 $\frac{9}{52}$
				~~1~~~~0~~~~2~~~~2~~
102			2160	~~1~~~~0~~

CHAP.

CHAP. XVII.

Of ALLIGATION.

THis Rule teacheth how to mix divers things, as Grains, Spices, Metals, Woolls, &c. of different prices together, so that a Quantity may be made up of those Severalls, of any Price and any Weight required.

Question 1.

A Grocer hath four several sorts of Spices, one of 2 *d.* another at 3 *d.* a third at 5 *d.* and a fourth at 6 *d.* the Ounce, of these he would make a Mixture to contain 50 Ounces, and that each Ounce should be worth 4 *d.*

Place the prices of the several prices one under another as you see here in the Margine, then with a crooked line linck or joyn two of them together with this Condition, that you alwayes linck a greater and a lesser, as here I have done 2 and 6, and 5 and 3 and not 2 and 3, and 5 and 6.

	d.		
	2	2	
d.	3	1	*On.*
4	5	1	50
	6	2	
		6	

This

This done, place the price required, *viz.* 4 *d.* by it ſelf towards the left hand, and towards the right hand note the ſeveral differences between the price of an ounce of every particular Spice, and of the Price required, as here the difference between 2 *d.* and 4 *d.* is 2 *d.* which I place (not againſt 2 *d.* the firſt price I took, but) againſt 6 *d.* which is lincked to it, likewiſe I take the difference between 3 *d.* and 4 *d.* which is 1, and ſet that againſt 5 *d.* which is lincked with 3 *d.* Again, I take the difference between 6 *d.* and 4 *d.* which is 2 *d.* and ſet that againſt 2 *d.* which is lincked with 6 *d.* And laſtly, I take the difference between 5 *d.* and 4 *d.* which is 1, and place that againſt 3 *d.* which is lincked with 5 *d.* then I add all theſe differences together, and they make 6, which I place under them, and then the work will ſtand as is before expreſſed. Now for the working of this Queſtion, or any other of the like nature, this is

THE RULE.

Multiply the ſum of the whole Maſs to be made, by any of the particular differences, and divide that Product by the Sum of all the Differences, the Quotient ſhall be the juſt quantity of that particular kind, whoſe price ſtandeth againſt that difference you multiplied with.

Example.

Example.

First, Multiply 50 ounces (the whole *Mass*) by 2, the difference which stands against 2 *d.*) and it makes 100, this divided by 6, (the sum of all the differences) gives $10\frac{4}{6}$ for the number of ounces that must be taken of the price of 2 *d.*

Secondly, multiply 50 the whole *Mass*, by 1, the difference standing against 3 *d.* it makes 50, which divide by 6, the sum of the differences, it gives $8\frac{2}{6}$ and so many ounces must be taken of the price of 3 *d.*

Now seeing the differences standing against 5 *d.* and 6 *d.* are 1 and 2, the same quantity of ounces as was taken for 3 *d.* must be taken also for 5 *d.* and the like quantity of that of 6 *d.* as was of 2 *d.* As by the work following will appear.

Ounci			*Oun.*		
6	50	2	6	50	1
	2				
	100		2	*On.*	*d.*
4	(4 *On.*	*d.*	50	($8\frac{2}{6}$ of 3	
100	($16\frac{4}{6}$ of 2		6		
66					

By this work you may perceive that you must take 16 Ounces $\frac{4}{6}$ of the Spice of 2 *d.* the Ounce. And also that you must take 8 Ounces, $\frac{2}{6}$ of that of 3 *d.* And because the differences against 5 *d.* and 6. are the same with those against 2 *d.* and 3 *d.* therefore take 8 $\frac{2}{6}$ ounces of that of 5 *d.* and 16 $\frac{4}{6}$ ounces of that of 6 *d.* And these four added together will make up 50 Ounces the required Mass, which may thus be easily proved, for,

Ounces		*d.*	
16 $\frac{4}{6}$	of that of	2	the Ounce.
8 $\frac{2}{6}$		3	
8 $\frac{2}{6}$		5	
16 $\frac{4}{6}$		6	

In all 50 Ounces.

But here it is to be observed, That there was no necessity of lincking the numbers as they were before lincked, but may be varied at pleasure, for whereas before I lincked 2 and 6, and 3 and 5, I might have lincked 2 and 5, and 3 and 6. But by this diversity of lincking, there will follow a diversity of answer to the question, but both of them true, as may appear by the following Work.

Example

Example.

Let the Numbers be lincked as here you see, the common price set on the left hand, and the several Mass on the right hand, and the sum of the difference under them, then multiplying 50 by 1, the product is 50, which divided by 6, the quotient is $8\frac{2}{6}$ and so much must be taken of the price of 2 *d.* and the rest as by the following operation doth appear.

	d.	
	2	1
d.	3	2
4	5	2
	6	1
sum		6

oun.
6 50 1
(2
~~50~~ ($8\frac{2}{6}$ of 2 *d.*
~~6~~

oun.
6 50 2
2
100
~~4~~(4
~~100~~ ($16\frac{4}{6}$ of 5 *d.*
~~66~~

oun.
6 50 2
2
100
~~4~~(4
~~100~~ ($16\frac{4}{6}$ of 3 *d.*
~~66~~

oun.
6 50 1
(2
~~50~~ ($8\frac{2}{6}$ of 6 *d.*
~~6~~

The

The Numbers being lincked as here, you must take

$$\left.\begin{array}{r} 8\frac{2}{7} \\ 16\frac{4}{7} \\ 16\frac{4}{7} \\ 8\frac{2}{7} \end{array}\right\}\text{Ounces of}\left\{\begin{array}{c} 2 \\ 3 \\ 5 \\ 6 \end{array}\right\}\text{the Ounce.}$$

In all 50 Ounces as before. But whereas before you took

$$\begin{array}{c}\textit{Ounces}\\ \left.\begin{array}{r} 16\frac{4}{7} \\ 8\frac{2}{7} \\ 8\frac{2}{7} \\ 16\frac{4}{7} \end{array}\right\}\end{array}\text{of}\left\{\begin{array}{c} 2 \\ 3 \\ 5 \\ 6 \end{array}\right\}\begin{array}{l}\text{you must}\\ \text{now take}\end{array}\left\{\begin{array}{r} 8\frac{2}{7} \\ 16\frac{4}{7} \\ 16\frac{4}{7} \\ 8\frac{2}{7} \end{array}\right\}\text{of}\left\{\begin{array}{c} 2 \\ 3 \\ 5 \\ 6. \end{array}\right.$$

Example 2.

A *Founder* hath six sorts of Metals, of several prices, one at two shillings, another at one shilling four pence, a third at ten pence, a fourth at five pence, a fifth at four pence, and a sixth at three pence the pound; of these he would make a mixture of thirty pound weight, so that the price of each pound weight should be nine pence; how much must he take of each sort?

Having placed the Numbers and lincked them together, and their differences, and the sum of these differences, distinctly as hath been shewed before, and as may be seen by the Example following, the manner of per-

formirg

forming the Work, will be as in the former Question,

	24	6
	16	5
	10	14
d. 9		l. 30
	5	1
	4	7
	3	15

sum of differences 38

Here (according to your Rule) you must multiply 30 (the whole Mass to be made) by 6 (the first difference) the product is 180, which divide by 38 the sum of all the differences, and the quotient will be $4\frac{8}{38}$, and so many Pounds must be taken of that sort of Metal of 2 s. the Pound, as by the work appears; and the like course must be taken for the rest.

1 For that of 2 *s.* the Pound.

	lib.	
38	30	6
	6	
	180	

2
~~6~~(8
~~1~~ 8 ~~0~~ (4 $\frac{28}{38}$ for that of 2 *s.*
~~3~~ 8

2 For that of 1 *s.* 4 *d.*

	lib.	
38	30	5
	5	
	150	

(3
~~6~~(6
~~1~~ ~~5~~ ~~0~~ (3 $\frac{36}{38}$ for that of 1 *s.* 4 *d.*
~~3~~ 8

3 For

3. For that of 10 *d.*

lib.

38 : 30 : 4

120

38 (3 $\frac{6}{38}$ for that of 10 *d.*

4. For that of 5 *d.*

lib.

30 30 1

0 $\frac{30}{38}$ for that of 5 *d.*

5. For that of 4 *d.*

lib.

38 30 7

7

210

~~6~~ (2
~~2~~ ~~1~~ ~~0~~ (5 $\frac{20}{38}$ for that of 4 *d.*
~~3~~8

6. For that of 3 *d.*

lib.

38 30 15
30
450.

(3
~~4~~
~~1~~ ~~7~~ (2
~~4~~ ~~5~~ ~~0~~ 11 $\frac{32}{38}$.
~~3~~ 8 8
~~3~~

4.	28
3.	36
3.	6
0.	30
5.	20
11.	32
26.	152

These particular quotients being added together (the Denominators of the Fractions being omitted) as in the Margin, their sum is 26 *lib.* and $\frac{152}{38}$ of a *lib.* divide therefore 152 by 38, and the quotient will be 4, which add to 26, and it makes 30 *lib.* the whole Masse required.

The

The same Question Resolved, the Numbers being otherwaies lincked.

	24	4	
	16	5	
d.	10	6	l.
9	5	15	30
	4	7	
	3	1	

30

[I.]

38   30   4

30
4

120

$\cancel{3}$ (6
$\cancel{1}\cancel{2}\cancel{0}$ ($3\frac{3}{19}$ for that of   d. 24
$\cancel{3}8$

[II.]

[II.]

38 30 5
5
———
150

(3
~~6~~(6 d.
~~150~~ (3 $\frac{36}{38}$ for that of 10
~~38~~

[III.]

38 30 6
6
———
180

(2
~~6~~(8 d.
~~180~~ (4 $\frac{28}{38}$ for that of 10
~~38~~

[IV.]

38 30 15
30
———
450

(3

(3
4
27 (2
450 (11 $\frac{32}{38}$ for that of 5 *d.*
388
3

[V.]

38 30
7

210
82
8(0
220 (5 $\frac{20}{38}$ for that of 4 *d.*
38

[VI.]

38 30
0 $\frac{30}{38}$ for that of 3 *d.*

By

By the different lincking of the numbers you may now see what difference ariseth in the quantities of the several sorts, for by the

First lincking

$$\text{you must take}\quad \begin{array}{r} \textit{lib.} \\ \left.\begin{array}{r} 4\frac{28}{38} \\ 3\frac{36}{38} \\ 3\frac{6}{38} \\ 0\frac{30}{38} \\ 5\frac{20}{38} \\ 11\frac{32}{38} \end{array}\right\} \\ \hline 30 \end{array} \quad \text{of that of} \quad \begin{array}{c} \textit{d.} \\ \left\{\begin{array}{r} 24 \\ 16 \\ 10 \\ 5 \\ 4 \\ 3 \end{array}\right\} \end{array}$$

Second lincking.

$$\begin{array}{r} \left\{\begin{array}{r} 3\frac{6}{38} \\ 3\frac{36}{38} \\ 4\frac{28}{38} \\ 11\frac{32}{38} \\ 5\frac{20}{38} \\ 0\frac{30}{38} \end{array}\right\} \\ \hline 30 \end{array} \quad \text{for that of} \quad \left\{\begin{array}{r} 24 \\ 16 \\ 10 \\ 5 \\ 4 \\ 3 \end{array}\right.$$

Question

Question 3.

A Goldsmith hath four sorts of Silver, one of 12 *p. w.* fine, another of 8 *p. w.* fine, a third of 6 *p. w.* fine, and a fourth of 3 *p. w.* fine, of these he would make an Ingot which should weigh 50 ounces, and should be 7 *p. w.* fine; how much must he take of each sort?

Having set down your several numbers and lincked them together, and set the differences and the sum of them, as also the common price of them on the left, and the Ingots weight on the right hand.

	12	1	
p. w.	8	4	*Ou.*
7	6	5	50
	3	1	
	11		

First multiply 50 the Ingots weight by 1 the first difference, the product is 50, which divide by 11, the sum of the differences, and the qotient will be 4$\frac{6}{11}$, and so many Ounces must be taken of that Silver of 12 *p. w.* fine.

Do

Do so for all the rest as you see done in the Example following.

Ou.

11 50 1

x(6 p.w.

5ø (4 $\frac{6}{11}$ for that of 12

xx

And seeing that the difference which stands against 3 p.w. fine is 1, you need not make it, but set down 4 $\frac{6}{11}$ Ounces for that also.

For 8 p.w. fine.

11 50 4

4

200

x

x9(2

x00 (18 $\frac{2}{11}$ for 8 p.w.

xxx

x

For 6 *p. w.* fine.

$4\frac{6}{11}$ 11 50 5.
$18\frac{2}{11}$ 5
$22\frac{8}{11}$ ——
$4\frac{6}{11}$ 250
—— ~~1~~
50 ~~3~~(8
~~250~~($22\frac{8}{11}$ for that of 6 *p. w.*
~~111~~
~~1~~

These four Numbers $4\frac{6}{11}$, $18\frac{2}{11}$, $22\frac{8}{11}$, and $4\frac{6}{11}$ added together, make 50, equal to the Ingots weight, which was required.

FINIS.

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